FINAL SUBMITTAL

ENERGY SURVEY OF

EISENHOWER ARMY MEDICAL CENTER
FORT GORDON

AUGUSTA, GEORGIA

VOLUME IV

PROJECT DOCUMENTS

CONTRACT NO. DACA01-94-D-0038

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

PREPARED BY:

REYNOLDS, SMITH AND HILLS, INC.
AEROSPACE AND DEFENSE PROGRAM
4651 SALISBURY ROAD
JACKSONVILLE, FLORIDA 32256

PROJECT NO. 6941331005

DECEMBER 23, 1996

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited. Distribution A. Approved for public release.

Marie Wakefield,
Librarian Engineering

TABLE OF CONTENTS

			PAGE
VOLUME IV--PROJECT DOCUMENTS			
1.	FEMP 1 ENERGY SAVING PROJECTS		FM1-1
	EL6	Convert to Energy Efficient Motors	FM1-2
	HS13	Use Damper Controls to Shut Off Air to Unoccupied Areas	FM1-3
	HS18	Reduce Heated or Cooled Outside Air	FM1-4
	HS24	Setback Supply and Exhaust Air for the Surgical Suite	FM1-5
	LT2	Reduce Lighting Levels	FM1-6
	LT4C1	Compact Fluorescents in Restrooms	FM1-7
	LT4C2	Compact Fluorescents in Lobby Area Downlights	FM1-8
	MI3B	Install Occupancy Sensors for Lighting Control in Breakrooms	FM1-9
2.	FEMP 2 EMERGENCY GENERATOR PARALLELING		FM2-1

ENERGY PROJECT

PROGRAMMING DOCUMENTATION

Project Number and Title

FEMP1 - Energy Saving Projects

Project Funding Category

Federal Energy Management Program (FEMP)

Contents

Attachment 1 - Description of Work

Attachment 2 - Life Cycle Cost Analysis Summary

Attachment 3 - Calculations, Cost Estimate and Back-up Data

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 1

DESCRIPTION OF WORK

FEMP 1 **ENERGY SAVING PROJECTS**

This project is a combination of the following ECOs. Their descriptions follow.

EL6	Convert to energy efficient motors
HS13	Use damper controls to shut off air to unoccupied areas
HS18	Reduce heated or cooled outside air
HS24	Surgical suite supply air reset
LT2	Reduce lighting levels
LT4C1	Retrofit compact fluorescents in restrooms
LT4C2	Retrofit compact fluorescents in lobby downlights
MI3B	Install occupational sensors to control lighting-breakrooms

ECO #EL6 Convert to Energy-Efficient Motors

Description

This project consists of replacing 29 existing standard-efficiency electric motors with high-efficiency electric motors. Supply, return, and exhaust fan motors are the primary candidates for replacement since they are not scheduled for removal during the FY96 Renovation Project.

Analysis

High-efficiency electric motors can save significant amounts of energy over standard efficiency types. It is always cost effective to replace failed standard efficiency motors with high efficiency units. Care should be taken when replacing standard motors with high-efficiency types because of their different operating speeds. High-efficiency motors typically operate about 1.5 percent faster than corresponding standard types. The result is a five-percent increase in load on the motor. The increased speed can be easily adjusted on AHUs, but not on pumps and other direct-coupled devices.

ECO #HS13 Use Damper Controls to Shut Off Air to Unoccupied Areas

Description

This project consists of installing variable frequency drives on fan motors; motorized dampers in the supply, return and exhaust ductwork; and associated controls for the fourth floor branches of AHU-4E and AHU-4W.

Analysis

The fourth floor of the hospital is primarily administrative offices which are only occupied during regular business hours. By using damper controls to shut off air to this area at night, significant energy and cost savings can be realized. Variable frequency drives (VFDs) are installed on two 125-hp supply fan motors, two 30-hp return air fan motors, one 7.5-hp exhaust fan motor and one five-hp exhaust fan motors. The VFDs have isolating transformers to protect the motors from power surges and spikes. Motorized dampers in the fourth floor branch ductwork and controls are included as part of this project. The damper control system will reset the VFDs to maintain required air flows on the fifth through fourteenth floors of the hospital. This can be done in the following manner. Measure total AHU airflow and airflow to the fourth floor with the fourth floor dampers open. Close fourth floor dampers and manually adjust the AHU VFD until the total flow is equal to the flow with the damper open less the fourth floor airflow (with damper open). Record this setting and use controls to reset the VFD to this position when dampers are closed.

ECO #HS18 Reduce Heated or Cooled Outside Air

Description

This ECO addresses the energy savings that can be achieved by reducing outside air (OSA) flows to design requirements for AHU-4E and AHU-4W.

Analysis

Design, measured and required outside air volumes were compared for the hospital. Four AHUs--4E, 4W, 5 and 6--show considerably more OSA than is required by Army standards. Two AHUs (5 and 6) are 100 percent OSA units and cannot be reduced with coincidently reducing cooling capacity. However, AHUs 4E and 4W can be reduced from 29 percent and 37 percent, respectively to 22.5 percent and 23.6 percent.

ECO #HS24 Setback Supply and Exhaust Air for the Surgical Suite

Description

This project utilizes the variable frequency drives (VFDs) and direct digital controls DDC installed with the funded renovations. The new DDC system will be programmed to setback the supply and exhaust fans during periods when the area is unoccupied. Manual override controls (hand/off/auto switch) will be installed in the Supervising Surgical Nurse's Station. This ECO will allow the supply and exhaust fans for the surgical suite to operate at reduced power at night and on weekends.

Analysis

The surgical suite is located on the third floor and includes the surgical intensive care unit, post anesthesia recovery ward, doctors lounge area and the operating rooms. These areas are typically not occupied at night or during weekends. Current supply air flow to the surgical suite provides approximately 8.25 air changes per hour. Supply air to these areas can be reduced to three air changes per hour during unoccupied times according to MIL-HDBK-1191, Military Handbook, DoD Medical and Dental Treatment Facilities, Design and Construction Criteria, October 15, 1991. Energy savings can be achieved by modulating the supply air volume to administrative areas when the cooling and heating loads are lower than the peak design loads.

Conditioned outside air is supplied to the surgical suite by SF-6 and exhausted by EF-6. The funded Renovation Project includes installing VFDs on the 40 horsepower motor for SF-6 and the five horsepower motor for EF-6. DDC hardware and software for day/night setback, speed control, start/stop, alarm status and power monitoring is also being installed.

A setback schedule and minimum flow rates for the supply and exhaust fans will be programmed into the DDC control system. The design positive pressure for the surgical suite is about 18 percent of the supply air flow. The minimum supply and exhaust flows will be set to maintain the same positive pressure during unoccupied times. The fans will be able to operate at full capacity during unoccupied times to maintain the required space conditions.

The project costs include labor for engineering, calibration, start-up and checkout for each control point. Fan motor energy savings will be achieved by operating the supply and exhaust fan motors at about 40 percent of full capacity during unoccupied hours. Calculations for fan motor energy savings are contained in the appendix.

ECO #LT2 Reduce Lighting Levels

Description

The ECO involves delamping fluorescent fixtures in over-lighted areas.

Analysis

Lighting levels were measured throughout the hospital. Some overlighted areas were observed. These are the fourth floor library, the medical records area in the family practice wing, most hallways and several offices and examination rooms.

All overlighted areas, except for hallways, use four lamp fluorescent fixtures. Removing one lamp from each hallway fixture would reduce average light levels in hallways from 30 to 35 foot candles to 15 to 18 foot candles. The fixtures in the family practice records area are circuited so that half of the lamps in the four-lamp fixtures can be de-energized from the wall switch. The fixtures in the fourth floor library would have to be delamped and ballasts disconnected.

ECO #LT4C1 Compact Fluorescents in Restrooms

Description

This ECO involves the one-for-one replacement of incandescent lamps with compact fluorescents in patient and other restroom areas.

Analysis

Most of the patient restrooms have incandescent fixtures. Compact fluorescents have incandescent fixtures. Compact fluorescents can be installed and improve the fixture efficiency from 15 lumens per watt to about 44 lumens per watt. Replace labor costs are also reduced since compact fluorescent lifetime is about 10,000 hours compared to 1,000 hours for an incandescent lamp.

ECO #LT4C2 Compact Fluorescents in Lobby Area Downlights

Description

In this ECO, 52-watt incandescents are replaced with 18-watt compact fluorescents in lobby area "high hat" fixtures.

Analysis

Incandescents are used for lighting in the south lobby of the fourth floor. Compact fluorescents offer increased efficiencies (44 lumens per watt, compared to 15 lumens per watt for incandescents) and increased lifetimes (10,000 hours versus 1,000 hours). This is particularly important in areas that are difficult to relamp such as high-ceiling lobbies.

ECO# MI3B Install Occupancy Sensors for Lighting Control in Breakrooms

Description

This ECO addresses occupancy sensors for breakrooms:

These devices can save energy by de-energizing lighting when intermittently used areas are not occupied.

Analysis

The cost effectiveness of occupancy sensors depends on how long can the lights be de-energized and how many watts of lighting are being turned off. Breakrooms were evaluated on actual lamp counts which are listed by room in the back materials.

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 2

LIFE CYCLE COST ANALYSIS SUMMARY

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: F_1
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: FEMP1 ENERGY SAVING PROJECTS
FISCAL YEAR 95 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 07-09-96 ECONOMIC LIFE 20 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$ 177200.	
B. SIOH	$ 10632.	
C. DESIGN COST	$ 10632.	
D. TOTAL COST (1A+1B+1C)	$ 198464.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 198464.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	5600.	$ 42672.	13.68	$ 583753.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	3521.	$ 9507.	17.25	$ 163991.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		9121.	$ 52179.		$ 747744.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 9000.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 116100.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)	$ 116100.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 61179.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.24 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 863844.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.35
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 12.58 %

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 3

CALCULATIONS, COST ESTIMATE AND BACK-UP DATA

FEMP #1 - Energy Saving Project

No.	ECO ID	Description	Construction Cost	Annual Savings Energy (MBtu/yr) Elec.	NGas	O&M	Annual Cost Savings	SIR	Simple Payback (yrs)
1	EL6	Convert to energy efficient motors	$17,200	284	-	-	$2,200	1.5	8.9
2	HS13	Use damper controls to shut off air to unoccupied areas	$111,500	2,041	1,505	-	$19,600	2.3	6.4
3	HS18	Reduce heated or cooled outside air	$1,100	136	32	-	$1,100	12.7	1.1
4	HS24	Surgical suite supply air reset	$1,400	738	1,984	-	$11,000	108.0	0.1
5	LT2	Reduce lighting levels	$5,500	1,158	-	-	$8,800	19.6	0.7
6	LT4C1	Retrofit compact fluor's in restrooms.	$37,500	231	-	$8,500	$10,300	3.3	4.0
7	LT4C2	Retrofit compact fluor's in lobby downlights.	$1,100	13	-	$500	$600	6.6	2.0
8	MI3B	Install occ. sensors to control lighting-breakrooms.	$1,900	999	-	-	$7,600	4.9	2.8
	Totals		$177,200	5,600	3,521	$9,000	$61,200	4.4	3.2

FW1-11

RS&H

SUBJECT Ft. Gordon
ECO Analysis
DESIGNER T. Todd
CHECKER

AEP NO --
SHEET 1 OF 1
DATE 3-1-96
DATE

ECO #EL6 Convert to energy-efficient motors.

Field survey notes were reviewed to determine which electric motors were candidates for analysis which were not scheduled to be changed out as part of the Renovation Project.

The table on p. EL6-2 contains the calculation and/or estimates of motor hp for exhaust fans whose nameplate data was not obtained during field surveys.

A preliminary screening analysis of all motors from 1 hp to 200 hp is shown on p. EL6-3. Since all motors from 5hp to 60 hp have a simple payback less than 10 years, these sizes were selected for detailed analysis.

Detailed energy and cost savings for specific motors were calculated on p. EL6-4 under current operation conditions and on p. EL-5 under projected operating conditions after the Renovation Project has been completed. Motor ID#'s refer to the following types:

ID#	Type
EF	AHU exhaust fan
HW Supply	Hot water supply pump
MUA	Make up air fan
RA	AHU Return air fan
SF	AHU Supply fan

Energy Efficient Motors										
Filename: EEMEF.XLS										
Fort Gordon										
Augusta, GA										
EXHAUST FAN NO	CFM	STATIC PRESS (IN)	CALC BHP	CALC MOTOR HP	MOTOR HP (EST)	MEAS'D KW	CALC HP FROM KW	MOTOR HP (EST)	FIELD DATA MOTOR HP	HP USED FOR EVAL
1	16600	0.75	3.26	5	5				5	5
2	22000	0.75	4.33	6	7.5				7.5	7.5
3	3700	1.75	1.70	3	3				2	3
4	16900	1.25	5.54	8	10				15	15
5	14400	0.75	2.83	4	5					5
6	27900	0.75	5.49	8	10					10
7	35600	2.75	25.67	35	40				100	100
8	6500	0.5	0.85	2	2				5	5
9	26000	0.5	3.41	5	5					5
10	1490	2	0.78	2	2					2
11	11950	-	-	-	-					
12	17300	0.75	3.40	5	5					5
13	15265	0.75	3.00	5	5	3.70	7.00	7.50		7.5
14	14700	0.75	2.89	4	5	0.75	2.00	2.00		5
15	12000	0.75	2.36	4	5	2.55	5.00	5.00		5
16	16610	0.75	3.27	5	5	4.00	8.00	10.00		10
17	325	2.5	0.21	1	1					1

Energy Efficient Motor Preliminary Analysis 19-Jun-96
Filename: EEM3.XLS
Site: Fort Gordon
Augusta, GA

Application : Various Motors Labor Cost: $27.50 /hr
Percent Motor Load: 75 %
Operating Hours : 8760 Hrs/Yr
Electric Rate
Energy : $0.026 /kWh
Demand : /kW

MOTOR HP	EXIST EFF (1)	ENERGY EFF (2)	EXIST KW	ENEFF KW	KW SAVE	KWH/YR SAVED	$/YR SAVED	MATL COST (3)	LABOR COST (4)	TOTAL COST (5)	SIMPLE PAYBACK	LABOR (HRS)
1.0	72.0%	84.0%	0.78	0.67	0.11	976	25	188	49	280	11.0	1.78
1.5	77.0%	84.0%	1.09	1.00	0.09	799	21	173	49	264	12.7	1.78
2.0	80.0%	84.0%	1.40	1.34	0.07	586	15	221	49	317	20.8	1.78
3.0	84.0%	90.2%	2.01	1.87	0.14	1,207	31	221	49	317	10.1	1.78
5.0	84.0%	89.5%	3.34	3.14	0.21	1,799	47	302	49	406	8.7	1.78
7.5	85.5%	91.7%	4.93	4.59	0.33	2,917	76	377	53	493	6.5	1.91
10.0	86.5%	91.7%	6.49	6.12	0.37	3,225	84	455	55	583	7.0	2.00
15.0	87.5%	93.0%	9.63	9.06	0.57	4,987	130	605	69	769	5.9	2.50
20.0	88.5%	93.6%	12.69	12.00	0.69	6,057	157	739	85	940	6.0	3.08
25.0	89.5%	94.1%	15.68	14.92	0.77	6,717	175	858	88	1,076	6.2	3.20
30.0	89.5%	94.1%	18.82	17.90	0.92	8,060	210	997	92	1,234	5.9	3.33
40.0	91.0%	95.0%	24.68	23.64	1.04	9,104	237	1,401	110	1,706	7.2	4.00
50.0	91.0%	95.0%	30.85	29.55	1.30	11,379	296	1,590	138	1,955	6.6	5.00
60.0	91.7%	95.4%	36.74	35.31	1.42	12,482	325	2,108	157	2,554	7.9	5.71
75.0	93.0%	95.4%	45.28	44.14	1.14	9,979	259	2,373	183	2,885	11.1	6.67
100.0	93.0%	95.4%	60.38	58.86	1.52	13,306	346	3,120	244	3,799	11.0	8.89
125.0	93.0%	95.4%	75.47	73.57	1.90	16,632	432	3,624	314	4,458	10.3	11.43
150.0	94.1%	96.2%	89.51	87.55	1.95	17,116	445	4,829	367	5,862	13.2	13.33
200.0	94.5%	95.8%	118.84	117.22	1.61	14,126	367	6,356	440	7,652	20.8	16.00

(1) NEMA nominal efficiency of a new standard efficient 1800 rpm ODP motor (460V, 3 phase).
(2) NEMA nominal efficiency of a new "GE Brand Premium Efficiency" 1800 RPM ODP motor.
(3) Grainger 1995 prices for GE Premium Efficiency, 1800 RPM, ODP motors
(4) Means 1995 Electrical Cost Data adjusted for Augusta, GA plus 53% mark-up.

EXISTING MOTORS- CURRENT OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	85.5%	10	8,760	85,986	$2,236	$0
EF-6,16	10	2	75%	86.5%	13	8,760	113,323	$2,946	$0
EF-4	15	1	75%	87.5%	10	8,760	84,021	$2,185	$0
SF-5	20	1	100%	88.5%	17	8,760	147,683	$3,840	$0
MUA	20	1	75%	88.5%	13	8,760	110,762	$2,880	$0
HW SUPPLY	25	3	75%	89.5%	47	5,840	273,811	$7,119	$0
RA-1A,1B,2A,2B	30	4	75%	89.5%	75	8,760	657,147	$17,086	$0
SF-6	40	1	100%	91.0%	33	8,760	287,251	$7,469	$0
		15			217		1,759,984	$45,760	$0

TOTAL ELECTRIC COST $45,760

HIGH EFFICIENCY MOTORS- CURRENT OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	91.7%	9	8,760	80,173	$2,084	$0
EF-6,16	10	2	75%	91.7%	12	8,760	106,897	$2,779	$0
EF-4	15	1	75%	93.0%	9	8,760	79,052	$2,055	$0
SF-5	20	1	100%	93.6%	16	8,760	139,636	$3,631	$0
MUA	20	1	75%	93.6%	12	8,760	104,727	$2,723	$0
HW SUPPLY	25	3	75%	94.1%	45	5,840	260,426	$6,771	$0
RA-1A,1B,2A,2B	30	4	75%	94.1%	71	8,760	625,023	$16,251	$0
SF-6	40	1	100%	95.0%	31	8,760	275,156	$7,154	$0
		15			206		1,671,089	$43,448	$0

TOTAL ELECTRIC COST	$43,448
ANNUAL KWH SAVINGS	88,895
ANNUAL COST SAVINGS	$2,311

SAVINGS

$$\frac{88,895 \text{ kwh} \times 3413}{1E6} = 303 \text{ MBtu}$$

EXISTING MOTORS- PROJECTED OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	85.5%	10	8,760	85,986	$2,236	$0
EF-6	10	1	75%	86.5%	6	8,760	56,662	$1,473	$0
EF-16	10	1	75%	86.5%	6	5,096	32,962	$857	$0
EF-4	15	1	75%	87.5%	10	8,760	84,021	$2,185	$0
SF-5	20	1	75%	88.5%	13	8,760	110,762	$2,880	$0
MUA	20	1	75%	88.5%	13	5,460	69,037	$1,795	$0
HW SUPPLY	25	3	75%	89.5%	47	5,840	273,811	$7,119	$0
RA-1A,1B,2A,2B	30	4	75%	89.5%	75	8,760	657,147	$17,086	$0
SF-6	40	1	100%	91.0%	33	8,760	287,251	$7,469	$0
		15			212		1,657,638	$43,099	$0

TOTAL ELECTRIC COST $43,099

HIGH EFFICIENCY MOTORS- PROJECTED OPERATING HOURS

MOTOR ID #	HP	NO	% LOAD	% EFF	KW	HRS/ YR	KWH/YR	ENERGY COST	DEMAND COST
EF-2,13	7.5	2	75%	91.7%	9	8,760	80,173	$2,084	$0
EF-6	10	1	75%	91.7%	6	8,760	53,448	$1,390	$0
EF-16	10	1	75%	91.7%	6	5,096	31,093	$808	$0
EF-4	15	1	75%	93.0%	9	8,760	79,052	$2,055	$0
SF-5	20	1	75%	93.6%	12	8,760	104,727	$2,723	$0
MUA	20	1	75%	93.6%	12	5,460	65,275	$1,697	$0
HW SUPPLY	25	3	75%	94.1%	45	5,840	260,426	$6,771	$0
RA-1A,1B,2A,2B	30	4	75%	94.1%	71	8,760	625,023	$16,251	$0
SF-6	40	1	100%	95.0%	31	8,760	275,156	$7,154	$0
		15			202		1,574,373	$40,934	$0

TOTAL ELECTRIC COST	$40,934
ANNUAL KWH SAVINGS	83,266
ANNUAL COST SAVINGS	$2,165

MBTU SAVINGS =

$$\frac{83{,}266 \text{ kwh} * 3413}{1{,}EEC}$$

= 284 MBTU/yr.

CONSTRUCTION COST ESTIMATE

Project:	Energy Efficient Motors	**RS&H No.:**	694-1331-005
Location:	Fort Gordon, GA	**Date:**	06/19/96
Basis:	Schematic Design	**Estimator:**	T. Todd
Building:	Hospital	**Filename:**	EST2-EL6.xls

ITEM DESCRIPTION	QUANTITY No.	Unit	MATERIAL/EQUIP $/Unit	Total	LABOR (1) $/Unit	Total	TOTAL COST	SOURCE Material	Labor
Hi-eff 1800 RPM, 7.5 hp	2	ea	377	754	112	224	978	Gp26,27	MEp199
Hi-eff 1800 RPM, 10 hp	2	ea	455	910	117	234	1,144	Gp26,27	MEp199
Hi-eff 1800 RPM, 15 hp	1	ea	605	605	147	147	752	Gp26,27	MEp199
Hi-eff 1800 RPM, 20 hp	2	ea	739	1,478	180	361	1,839	Gp26,27	MEp199
Hi-eff 1800 RPM, 25 hp	3	ea	858	2,574	188	563	3,137	Gp26,27	MEp199
Hi-eff 1800 RPM, 30 hp	4	ea	997	3,988	195	781	4,769	Gp26,27	MEp199
Hi-eff 1800 RPM, 40 hp	1	ea	1,401	1,401	234	234	1,635	Gp26,27	MEp199
Subtotal Bare Costs				11,710		2,544	14,254		
Retrofit Cost Factors			0%	0	0%	0	0	MMp6	MMp6
Subtotal				11,710		2,544	14,254		
City Cost Index (Aug. GA)			0%	0	-46%	(1,170)	(1,170)	MMp533	MMp533
Subtotal				11,710		1,374	13,084		
OH & Profit Markups			10%	1,171	53%	728	1,899	MMp7	MMp475
Subtotal				12,881		2,102	14,983		
Sales Taxes			6.0%	773		NA	773	MMp476	
Subtotal				13,654		2,102	15,756		
Contingency			10%	1,171	10%	254	1,425	MEp6	MEp6
Construction Cost				14,825		2,356	17,181		
Design Fee				NA	6.0%	1,031	1,031		
SIOH				NA	6.0%	1,031	1,031		
Total Project Cost				14,825		4,418	19,243		

(1) Labor cost includes removal of old motors and installation of new motors, and is equal to twice the Means cost for installation.

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###.
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###.

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: EL6
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-EL6 ENERGY EFFICIENT MOTORS
FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 17200.		
B. SIOH	$ 1032.		
C. DESIGN COST	$ 1032.		
D. TOTAL COST (1A+1B+1C)	$ 19264.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.		
F. PUBLIC UTILITY COMPANY REBATE	$ 0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 19264.	

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	284.	$ 2164.	13.68	$ 29605.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		284.	$ 2164.		$ 29605.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 2164.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.90 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 29605.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 1.54
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.87 %

RS&H

SUBJECT ECO-HS13 Ft. Gordon
DESIGNER B. Todd
CHECKER I. Todd
AEP NO 694-1331-005
SHEET ___ OF ___
DATE 3-1-96
DATE ___

ECO-HS13 Use Damper Controls to Shut Off Air to Unoccupied Areas

AHU-4E and AHU-4W serve the 4th through 4th floors of the hospital. The 4th floor is primarily administrative offices which are only occupied during regular business hours. For this project evaluation, it is assumed that the 4th floor air will be turned off from 6 pm to 6 am.

Since one AHU serves many floors, outlett dampers and variable inlet vanes would not be suitable damper controls to reduce the air flow to the fourth floor because these controls would reduce air to all areas. Variable frequency drives on the supply, return & exhaust fan motors with motorized dampers can be used effectively in this application and are evaluated here.

The fans serving the 4th floor are listed on p. HS13-3, as well as the proposed AHU control diagram. Air flows for the 4 zones of the 4th floor are shown on p. HS13-4. From these calculations, the percents of design cfm that the 4th floor uses out of the total cfm for AHU's 4E & 4W is estimated at 20% supply, 20% return and 10% exhaust.

Energy savings shown on this page are results of simple hand calculations. Computer simulation results are used in the final evaluation (p. HS13-13).

Energy savings for the 125 hp, 30 hp, 7.5 hp and 5 hp fan motors are calculated on p. HS13-5 through p. HS13-8. BHP is assumed to equal HP. Efficiencies are from Grainger for standard efficiency General Electric, 3 phase ODP motors.

Total energy savings = 2(214,319) + 2(53,448) + 7767 + 5271 = 548,572 kwh/yr
Total cost savings = 2(5572) + 2(1390) + 202 + 137 = $14,263/yr

RS&H

SUBJECT ECO-HS13 Ft. Gordon
DESIGNER B. Todd
CHECKER T. Todd

AEP NO 604-1331-005
SHEET ____ OF ____
DATE 3-1-96
DATE ____

ECO-HS13 (cont.)

The Construction Cost Estimate for this ECO is shown on p. HS13-9. Details of the variable frequency drive and isolating transformer costs are tabulated on p. HS13-10. Details of the VAV damper with motor costs are on p. HS13-11. Actual duct sizes are shown on the Construction Cost Estimate, although the replacements may be a different size and may require multiple units as listed on p. HS13-11.

RS&H

SUBJECT ECO-HS13 AEP NO 694-1331-005
DESIGNER B. Todd SHEET ____ OF ____
CHECKER T. Todd DATE 3-1-96
DATE ____

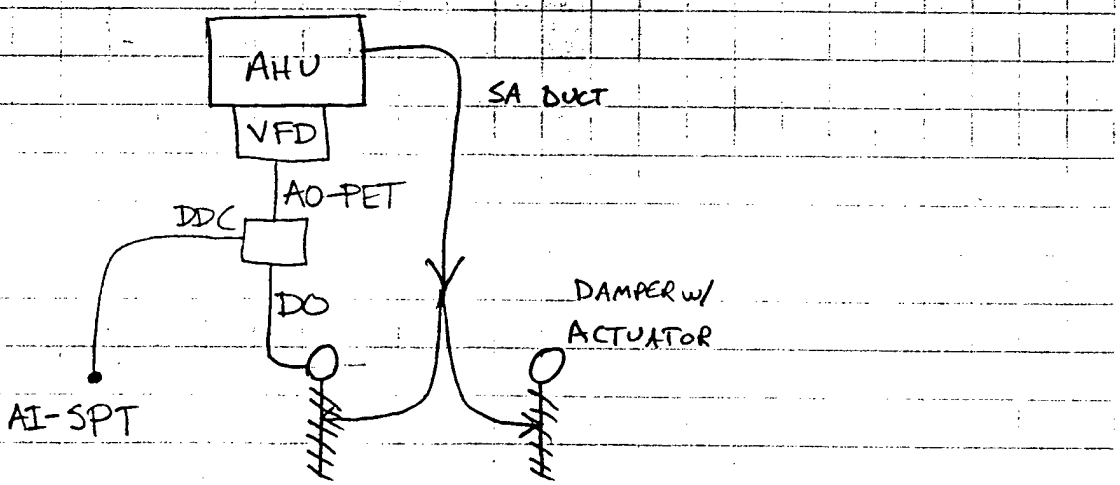
Motors - Variable Frequency Drives

AHU	FAN TYPE	FAN #	MOTOR HP
4W	SUPPLY	SF-4A	125
	RETURN	RA-2A	30
	EXHAUST	EF-1	5
4E	SUPPLY	SF-4B	125
	RETURN	RA-2B	30
	EXHAUST	EF-2	7.5

FROM AIR FLOWS SPREADSHEET,

SUPPLY % REDUCTION ≅ 20%
RETURN % REDUCTION ≅ 20%
EXHAUST % REDUCTION ≅ 10%

Vary fan speed as needed to maintain a constant pressure at the static pressure sensor for system.
Revert to full speed on failure.



Air Flows for Hospital, 4th Floor
Filename: VAV-4FL.WB2
Location: Fort Gordon, GA

Plan Area	AHU	Zone	Supply		Return		Exhaust	
			Duct Size	CFM	Duct Size	CFM	Duct Size	CFM
A & B	4 W	Northwest	22 ø	8230	54 x 20	7430	10 x 8	190
A & B	4 W	Southwest	22 ø	8625	52 x 20	7320	14 x 8	320
C & B	4 E	Northeast	18 x 18	6190	52 x 16	6250	20 x 14	1415
C & B	4 E	Southeast	20 x 20	7610	62 x 18	5905	26 x 12	1435
A & B	4 W	4th Fl, West		16855		14750		510
Percent of design cfm				21%		25%		3%
C & B	4 E	4th Fl, East		13800		12155		2850
Percent of design cfm				16%		18%		13%
4th Floor	4E & 4W	4th Fl, All		30655		26905		3360
Percent of design cfm				18%		21%		9%
Design	4 W	West, All		80500		59885		16665
Actual	4 W	West, All		102000		64710		37330
Design	4 E	East, All		85265		65935		21945
Actual	4 E	East, All		107000		76250		30700

(1) Assumes exhaust air cfm is equal to outside air cfm.

Variable Frequency Drive Preliminary Analysis 03/01/96
Filename: ECOHS13a.WB2
Application: Fort Gordon Hospital, 4th Floor

Motor bhp :	125 bhp	Exist. Control :	N/C
Motor Eff.:	93.0 %	New Control:	VFD
Oper Hours:	8760 Hours/Year		
Elec. Rate:	$0.026 /kWh		

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER N/C	DMPR	VIV	VFD	HORSEPOWER * HOURS N/C	DMPR	VIV	VFD
12.0	0.50	100%	125.00	125.00	125.00	125.00	547,500	547,500	547,500	547,500
0.0	0.00	90%	125.00	121.25	106.25	91.13	0	0	0	0
12.0	0.50	80%	125.00	118.75	87.50	64.00	547,500	520,125	383,250	280,320
0.0	0.00	70%	125.00	112.50	81.25	42.87	0	0	0	0
0.0	0.00	60%	125.00	106.25	75.00	27.00	0	0	0	0
0.0	0.00	50%	125.00	100.00	68.75	15.63	0	0	0	0
0.0	0.00	40%	125.00	93.75	62.50	8.00	0	0	0	0
24.0	1.00				Totals		1,095,000	1,067,625	930,750	827,820

	Energy Use		Energy Cost	
N/C = No Control	878,355	kWh/Yr	$22,837	/Yr
DMPR = Outlet Damper	856,396	kWh/Yr	$22,266	/Yr
VIV = Vari. Inlet Vane	746,602	kWh/Yr	$19,412	/Yr
VFD = Vari. Freq. Drive	664,036	kWh/Yr	$17,265	/Yr

Annual Savings for: VFD vs N/C

Energy Savings =	214,319	kWh/Year
Cost Savings =	$5,572	/Year

Notes:
1. Equation for VFD HP is: HP2 = (Q2/Q1)^3 x HP1
2. Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis 03/01/96
Filename: ECOHS13b.WB2
Application: Fort Gordon Hospital, 4th Floor

Motor bhp :	30 bhp	Exist. Control :	N/C
Motor Eff.:	89.5 %	New Control:	VFD
Oper Hours:	8760 Hours/Year		
Elec. Rate:	$0.026 /kWh		

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER N/C	DMPR	VIV	VFD	HORSEPOWER * HOURS N/C	DMPR	VIV	VFD
12.0	0.50	100%	30.00	30.00	30.00	30.00	131,400	131,400	131,400	131,400
0.0	0.00	90%	30.00	29.10	25.50	21.87	0	0	0	0
12.0	0.50	80%	30.00	28.50	21.00	15.36	131,400	124,830	91,980	67,277
0.0	0.00	70%	30.00	27.00	19.50	10.29	0	0	0	0
0.0	0.00	60%	30.00	25.50	18.00	6.48	0	0	0	0
0.0	0.00	50%	30.00	24.00	16.50	3.75	0	0	0	0
0.0	0.00	40%	30.00	22.50	15.00	1.92	0	0	0	0
24.0	1.00				Totals		262,800	256,230	223,380	198,677

	Energy Use		Energy Cost	
N/C = No Control	219,049	kWh/Yr	$5,695	/Yr
DMPR = Outlet Damper	213,573	kWh/Yr	$5,553	/Yr
VIV = Vari. Inlet Vane	186,192	kWh/Yr	$4,841	/Yr
VFD = Vari. Freq. Drive	165,601	kWh/Yr	$4,306	/Yr

Annual Savings for: VFD vs N/C

Energy Savings =	53,448	kWh/Year
Cost Savings =	$1,390	/Year

Notes:
1. Equation for VFD HP is: HP2 = (Q2/Q1)^3 x HP1
2. Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis 03/01/96
Filename: ECOHS13c.WB2
Application: Fort Gordon Hospital, 4th Floor

Motor bhp :	7.5 bhp	Exist. Control :	N/C
Motor Eff.:	85.5 %	New Control:	VFD
Oper Hours:	8760 Hours/Year		
Elec. Rate:	$0.026 /kWh		

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER N/C	DMPR	VIV	VFD	HORSEPOWER * HOURS N/C	DMPR	VIV	VFD
12.0	0.50	100%	7.50	7.50	7.50	7.50	32,850	32,850	32,850	32,850
12.0	0.50	90%	7.50	7.28	6.38	5.47	32,850	31,864	27,923	23,948
0.0	0.00	80%	7.50	7.13	5.25	3.84	0	0	0	0
0.0	0.00	70%	7.50	6.75	4.88	2.57	0	0	0	0
0.0	0.00	60%	7.50	6.38	4.50	1.62	0	0	0	0
0.0	0.00	50%	7.50	6.00	4.13	0.94	0	0	0	0
0.0	0.00	40%	7.50	5.63	3.75	0.48	0	0	0	0
24.0	1.00				Totals		65,700	64,715	60,773	56,798

	Energy Use		Energy Cost	
N/C = No Control	57,324	kWh/Yr	$1,490	/Yr
DMPR = Outlet Damper	56,464	kWh/Yr	$1,468	/Yr
VIV = Vari. Inlet Vane	53,025	kWh/Yr	$1,379	/Yr
VFD = Vari. Freq. Drive	49,557	kWh/Yr	$1,288	/Yr

Annual Savings for: VFD vs N/C

Energy Savings =	7,767	kWh/Year
Cost Savings =	$202	/Year

Notes:
1. Equation for VFD HP is: HP2 = (Q2/Q1)^3 x HP1
2. Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis 03/01/96
Filename: ECOHS13d.WB2
Application: Fort Gordon Hospital, 4th Floor

Motor bhp :	5 bhp	Exist. Control :	N/C
Motor Eff.:	84.0 %	New Control:	VFD
Oper Hours:	8760 Hours/Year		
Elec. Rate:	$0.026 /kWh		

Oper Hr/Day	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER N/C	DMPR	VIV	VFD	HORSEPOWER * HOURS N/C	DMPR	VIV	VFD
12.0	0.50	100%	5.00	5.00	5.00	5.00	21,900	21,900	21,900	21,900
12.0	0.50	90%	5.00	4.85	4.25	3.65	21,900	21,243	18,615	15,965
0.0	0.00	80%	5.00	4.75	3.50	2.56	0	0	0	0
0.0	0.00	70%	5.00	4.50	3.25	1.71	0	0	0	0
0.0	0.00	60%	5.00	4.25	3.00	1.08	0	0	0	0
0.0	0.00	50%	5.00	4.00	2.75	0.63	0	0	0	0
0.0	0.00	40%	5.00	3.75	2.50	0.32	0	0	0	0
24.0	1.00				Totals		43,800	43,143	40,515	37,865

	Energy Use		Energy Cost	
N/C = No Control	38,899	kWh/Yr	$1,011	/Yr
DMPR = Outlet Damper	38,315	kWh/Yr	$996	/Yr
VIV = Vari. Inlet Vane	35,981	kWh/Yr	$936	/Yr
VFD = Vari. Freq. Drive	33,628	kWh/Yr	$874	/Yr

Annual Savings for: VFD vs N/C

Energy Savings =	5,271	kWh/Year
Cost Savings =	$137	/Year

Notes:
1. Equation for VFD HP is: HP2 = (Q2/Q1)^3 x HP1
2. Q = volume air flow, cfm

Cost Estimate for Variable Frequency Drive & Installation
Filename: VSD_COST.WB2

Feb-96

Motor HP	Variable Frequency Drive Bare Cost, $ (1)			Estim. KVA (2)	Trans. KVA	Isolating Transformer Bare Cost, $ (3)			VFD & Isolating Trans. Total Bare Cost, $		
	Material	Labor	Total			Material	Labor	Total	Material	Labor	Total
3	3150	420	3570	3	3	380	167	547	3530	587	4117
5	3450	420	3870	4	5	485	195	680	3935	615	4550
7.5	3575	500	4075	7	7.5	645	213	858	4220	713	4933
10	3675	500	4175	9	10	800	293	1093	4475	793	5268
15	4025	755	4780	13	15	1200	390	1590	5225	1145	6370
20	4825	755	5580	17	20 *	1313	430	1743	6138	1185	7323
25	5475	995	6470	21	25	1425	470	1895	6900	1465	8365
30	6575	995	7570	25	25	1425	470	1895	8000	1465	9465
40	7275	995	8270	33	37.5	1550	585	2135	8825	1580	10405
50	8300	1275	9575	41	45 *	1725	612	2337	10025	1887	11912
60	9650	1752	11402	49	60 *	2075	666	2741	11725	2418	14143
75	11900	1752	13652	60	75	2425	720	3145	14325	2472	16797
100	13800	1960	15760	80	94 *	2913	743	3655	16713	2703	19415
125	15600	1960	17560	100	112.5	3400	765	4165	19000	2725	21725
150	19200	1960	21160	119	150	4375	807	5182	23575	2767	26342
200	22200	2375	24575	158	188 *	5113	932	6044	27313	3307	30619
250 *	25200	2790	27990	196	225	5850	1056	6906	31050	3846	34896

NOTES:

1. Costs for VFD's from Means Electrical Cost Data, 1996, pages 178 & 179.
2. Assumes motor efficiency for GE, standard efficiency, 3 phase, ODP motor.
3. Costs for isolating transformers from Means Electrical Cost Data, 1996, page 202.

* Size not listed in Means, costs estimated by interpolation or extrapolation.

RS&H

SUBJECT ECOHS13

DESIGNER B. Todd

CHECKER T. Todd

AEP NO

SHEET ____ OF ____

DATE 3-1-96

DATE

4th Floor Duct Sizes and Damper Costs

	Actual Size	Qty	Replacement Size	VAV Damper w/ motor $ MAT (ea)	$ LABOR (ea)
Supply ↓	22" ϕ	2	24"×12"	144	29
	22" ϕ	2	24"×12"	144	29
	18"×18"	1	18"×18"	139	29
	20"×20"	2	24"×12"	144	29
RETURN ↓	54"×20"	3	18"×20"	151	33
	52"×20"	3	18"×20"	151	33
	52"×16"	2	28"×16"	256	38.5
	62"×18"	2	30"×24"	305	61
EXHAUST ↓	10"×8"	1	10"×10"	117	17.8
	14"×8"	1	16"×10"	121	19.3
	20"×14"	1	20"×14"	142	29
	26"×12"	1	16"×12"	126	21
		1	12"×12"	120	19.3

Source (MATERIALS & LABOR): 1996 Means Mechanical p. 328.

CONSTRUCTION COST ESTIMATE

Project:	ECO-HS13, VFD w/Dampers, 4th Floor	RS&H No.:	694-1331-005
Location:	Fort Gordon, GA	Date:	03/05/96
Basis:	Schematic Design	Estimator:	W. T. Todd
Building:	Eisenhower Army Medical Center	Filename:	est-hs13.wb2

ITEM DESCRIPTION	QUANTITY		MATERIAL		LABOR		TOTAL	SOURCE	
	No.	Unit	$/Unit	Total	$/Unit	Total	COST	Material	Labor
VFD w/ Iso Trans, 125 hp	2	Ea	19000	38000	2725	5450	43,450	(1)	(1)
VFD w/ Iso Trans, 30 hp	2	Ea	8000	16000	1465	2930	18,930	(1)	(1)
VFD w/ Iso Trans, 7.5 hp	1	Ea	4220	4220	713	713	4,933	(1)	(1)
VFD w/ Iso Trans, 5 hp	1	Ea	3935	3935	615	615	4,550	(1)	(1)
VAV Damper w/ motor									
NW supply, 22" rnd	1	Ea	288	288	58	58	346	MMp328	MMp328
NW return, 54x20	1	Ea	453	453	99	99	552	MMp328	MMp328
NW Exh., 10x8	1	Ea	117	117	17.8	18	135	MMp328	MMp328
SW supply, 22" rnd	1	Ea	288	288	58	58	346	MMp328	MMp328
SW return, 52x20	1	Ea	453	453	99	99	552	MMp328	MMp328
SW Exh., 14x8	1	Ea	121	121	19.3	19	140	MMp328	MMp328
NE supply, 18x18	1	Ea	139	139	29	29	168	MMp328	MMp328
NE return, 52x16	1	Ea	512	512	77	77	589	MMp328	MMp328
NE Exh., 20x14	1	Ea	142	142	29	29	171	MMp328	MMp328
SE supply, 20X20	1	Ea	288	288	58	58	346	MMp328	MMp328
SE return, 62X18	1	Ea	610	610	122	122	732	MMp328	MMp328
SE Exh., 26X12	1	Ea	246	246	40.3	40	286	MMp328	MMp328
Transformer, 40VA	12	Ea	23.5	282	14.5	174	456	MMp328	MMp328
DDC Controller, 32 point	1	Ea		0	3269	3269	3,269		MMp317
AI, Static Press. Sensor	6	Ea		0	340	2040	2,040		MMp317
AO, Elec. Controller	6	Ea		0	229	1373	1,373		MMp317
DO, On/Off Control	12	Ea		0	360	4315	4,315		MMp317
#18-2 wire in 1/2" EMT	27	CLF	7.6	205	29.5	797	1,002	MEp140	MEp140
Conduit, 1/2" EMT	900	LF	0.3	270	0.54	486	756	MEp105	MEp105
Subtotal Bare Costs				66569		22868	$89,437		
Retrofit Cost Factors			5%	3328	5%	1143	4,471	MMp6	MMp6
Subtotal				69897		24011	93,908		
City Cost Index (Aug. GA)			0%	0	-46%	-11045	(11,045)	MMp533	MMp533
Subtotal				69897		12966	82,863		
OH & Profit Markups			10%	6990	53%	6872	13,862	MMp7	MMp475
Subtotal				76887		19838	96,725		
Sales Taxes			6.0%	4613		NA	4,613	MMp476	
Subtotal				81500		19838	101,338		
Contingency			10%	8150	10%	1984	10,134	MEp6	MEp6
Total Construction Cost				89650		21822	111,472		
Design Fee				NA	6.0%	6688	6,688		
SIOH				NA	6.0%	6688	6,688		
Total Project Cost				89650		35198	$124,848		

LEGEND:

(1)	See VFD cost sheet.
MEp###	1996 Means Electrical Cost Data, page ###.
MMp###	1996 Means Mechanical Cost Data, page ###.

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: HS13
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-HS13 SHUT OF AIR W/ DAMPER CONTROLS
FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 111500.	
B. SIOH	$ 6690.	
C. DESIGN COST	$ 6690.	
D. TOTAL COST (1A+1B+1C)	$ 124880.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 124880.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	2041.	$ 15552.	13.68	$ 212757.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	1505.	$ 4064.	17.25	$ 70095.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		3546.	$ 19616.		$ 282853.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 19616.

5. SIMPLE PAYBACK PERIOD (1G/4) 6.37 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 282853.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 2.26
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 8.96 %

****
****
**
** TRACE 600 ANALYSIS **
**
** by C.D.S. MARKETING **
**
****
****

EISENHOWER ARMY MEDICAL CENTER
AUGUSTA, GA
SAVANNAH DISTRICT CORPS OF ENGINEERS
REYNOLDS, SMITH & HILLS
SCHEDULE AIR TO 4TH FLOOR

ECO # HS13 DAMPER Controls

			ELC (kWh)	NGAS (therms)
Weather File Code:	AUGUSTA			
Location:				
Latitude:	33.0	(deg)		
Longitude:	82.0	(deg)		
Time Zone:	5			
Elevation:	143	(ft)	22,118,931	622,460
Barometric Pressure:	29.8	(in. Hg)	21,521,022	607,408
			597,909	15,052
Summer Clearness Number:	0.90			
Winter Clearness Number:	0.90			
Summer Design Dry Bulb:	95	(F)		
Summer Design Wet Bulb:	76	(F)		
Winter Design Dry Bulb:	23	(F)	2041 MBTU	1505 MBTU
Summer Ground Relectance:	0.20			
Winter Ground Relectance:	0.20			

Air Density:	0.0756	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	1.1094	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,883.6	(Btu-min./hr/cuft)
Enthalpy Factor:	4.5387	(Lb-min./hr/cuft)

Design Simulation Period: July To July
System Simulation Period: January To December
Cooling Load Methodology: CEC-DOE2/Exact TFM method with CEC\DOE 2.1c constraints

Time/Date Program was Run: 14:30:42 6/27/96
Dataset Name: DAMPER .TM

Trane Air Conditioning Economics
By: C.D.S. MARKETING

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	1,499,168	2,701	77,316	2,029	188
Feb	1,329,888	2,698	72,127	1,806	188
March	1,635,049	2,793	58,684	2,107	183
April	1,750,917	2,941	44,268	2,330	163
May	1,922,752	3,324	40,014	2,780	156
June	2,126,510	3,604	34,758	3,515	152
July	2,235,160	3,599	36,769	3,751	153
Aug	2,212,806	3,628	36,801	3,741	154
Sept	1,978,412	3,459	37,986	3,006	156
Oct	1,688,798	2,870	50,985	2,093	168
Nov	1,579,336	2,825	53,652	1,958	178
Dec	1,562,227	2,730	64,046	1,958	185
Total	21,521,022	3,628	607,408	31,072	188

Building Energy Consumption = 183,187 (Btu/Sq Ft/Year) Floor Area = 732,541 (Sq Ft)
Source Energy Consumption = 388,119 (Btu/Sq Ft/Year)

H313-14

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

UTILITY PEAK CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 3,628.3 (kW)
Yearly Time of Peak 18 (hr) 8 (mo)

Hour 18 Month 8

Eqp. Ref. Num.	Equipment Code	Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment					
1	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS		761.9	21.00
2	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS		604.7	16.66
4	EQ1307	PACKAGED TERMINAL AIR CONDITIONER		26.8	0.74
5	EQ1120L	AIR-CLD RECIPROCATING > 22 TONS		63.5	1.75
Sub Total				1,456.9	40.15
Heating Equipment					
1	EQ2002	GAS FIRED STEAM BOILER		56.0	1.54
Sub Total				56.0	1.54
Air Moving Equipment					
1		SUMMATION OF FAN ELECTRICAL DEMAND		102.3	2.82
2		SUMMATION OF FAN ELECTRICAL DEMAND		102.1	2.81
3		SUMMATION OF FAN ELECTRICAL DEMAND		82.8	2.28
4		SUMMATION OF FAN ELECTRICAL DEMAND		94.9	2.62
5		SUMMATION OF FAN ELECTRICAL DEMAND		21.5	0.59
6		SUMMATION OF FAN ELECTRICAL DEMAND		34.7	0.96
7		SUMMATION OF FAN ELECTRICAL DEMAND		88.1	2.43
8		SUMMATION OF FAN ELECTRICAL DEMAND		1.5	0.04
9		SUMMATION OF FAN ELECTRICAL DEMAND		8.4	0.23
10		SUMMATION OF FAN ELECTRICAL DEMAND		76.0	2.09
Sub Total				612.3	16.88
Sub Total				0.0	0.00
Miscellaneous					
Lights				732.6	20.19
Base Utilities				0.0	0.00
Misc Equipment				770.6	21.24
Sub Total				1,503.1	41.43
Grand Total				3,628.3	100.00

HS13-15

CALIFORNIA TITLE 24 COMPLIANCE - ALTERNATIVE 1

---------- CALIFORNIA TITLE 24 COMPLIANCE REPORT ----------

Weather Name ..... AUGUSTA
Gross Conditioned Floor Area (sqft)..... 732,541
ACM Multiplier 1.025

---------- E N E R G Y U S E S U M M A R Y ----------

	ELEC (kWh/yr)	GAS (kBtu/yr)	WATER (1000 gal)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	141,955.8	33,801,960.0	378.8	25.6	37,034,640.0	51.8
Primary Cooling						
Compressor	2,668,985.2	0.0	0.0	6.8	27,330,472.0	38.2
Tower/Cond Fans	536,585.9	0.0	30,391.1	1.4	5,494,652.5	7.7
Condenser Pump	1,020,989.8	0.0	0.0	2.6	10,454,960.0	14.6
Other Accessories	815,059.0	0.0	0.0	2.1	8,346,223.5	11.7
Auxiliary						
Supply Fans	5,016,097.5	0.0	0.0	12.8	51,364,956.0	71.9
Circulation Pumps	677,818.1	0.0	0.0	1.7	6,940,873.0	9.7
Base Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	5,693,915.5	0.0	0.0	14.5	58,305,828.0	81.6
Lighting	5,344,352.5	0.0	0.0	13.6	54,726,296.0	74.7
Receptacle	5,299,176.5	0.0	0.0	13.5	54,263,692.0	74.1
Domestic Hot Water	0.0	26,938,834.0	301.9	20.1	28,356,668.0	38.7
Cogeneration	0.0	0.0	0.0	0.0	0.0	0.0
Totals	21,521,020.0	60,740,792.0	31,071.7	100.0	284313440.0	393.1

01 Card - Job Information

Project: EISENHOWER ARMY MEDICAL CENTER
Location: AUGUSTA, GA
Client: SAVANNAH DISTRICT CORPS OF ENGINEERS
Program User: REYNOLDS, SMITH & HILLS
Comments: SCHEDULE AIR TO 4TH FLOOR

Card 08---------- Climatic Information ----------

Weather Code	Summer Clearness Number	Winter Clearness Number	Summer Design Dry Bulb	Summer Design Wet Bulb	Winter Design Dry Bulb	Building Orientation	Summer Ground Reflect	Winter Ground Reflect
AUGUSTA								

Card 09---------- Load Simulation Periods ----------

1st Month Cooling Simulation	Last Month Cooling Simulation	Peak Cooling Load Hr	1st Month Summer Period	Last Month Summer Period	1st Month Daylight Savings	Last Month Daylight Savings
JUL	JUL					

Card 10---------- Load Simulation Parameters ----------

Cooling Load Method	Heating Load Method	Ventilation Method	Airflow Input Units	Airflow Output Units	Room Circulation Rate	Put Wall RA Load to Room
CEC-DOE2	CEC-DOE2					

Card 11---------- Energy Simulation Parameters ----------

1st Month Energy Simulation	Last Month Energy Simulation	Level Of Calculation	Holiday Code	Calendar Code	Building Floor Area
JAN	DEC	ZONE		2001	

---------- Load Section Alternative #1 ----------

Card 19- Load Alternative -

Number	Description
1	BASELINE

H313-17

Card 25---------- Wall/Glass Parameters ----------

Room Number	Wall Number	Glass Length	Glass Width	Pct Glass or No. of Windows	Glass U-Value	Shading Coefficient	External Shading Type	Internal Shading Type	Percent Solar to Ret. Air	Visible Transmittance	Inside Visible Reflectance
534	1										
M610	1			10	1.04	0.9	3	3			
612	1										
614	1										
620	1										
622	1										
630	1										
632	1										
634	1										
710	1										
712	1										
714	1										
720	1										
722	1										
724	1										
M900	1			20	1.04	1.		3			
902	1										
904	1										
906	1										

Card 26---------- Schedules ----------

Room Number	People	Lights	Ventilation	Infiltration	Reheat Minimum	Cooling Fans	Heating Fan	Auxiliary Fan	Room Exhaust	Daylighting Controls
M100	A-P8HPD	A-L8HPD	AVAIL	OFF		AVAIL	AVAIL	AVAIL	AVAIL	
160	AVAIL	AVAIL								
170	AVAIL	AVAIL								
180	AVAIL	AVAIL								
190	NONE	NONE	NONE	NONE		NONE	NONE			
M210	AVAIL	AVAIL	AVAIL	AVAIL		AVAIL	AVAIL	AVAIL	AVAIL	
240	NONE	NONE	NONE	NONE		NONE	NONE			
M300	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
302						A-MODSKF			A-MODSKF	
330	A-P8HPD	A-L8HPD								
332	A-P8HPD	A-L8HPD								
334	A-P8HPD	A-L8HPD								
350	NONE	NONE	NONE	NONE		NONE	NONE			
M400	A-P8HPD	A-L8HPD	AVAIL	AVAIL	A-DAMPER					
M510	AVAIL	AVAIL	AVAIL	OFF		AVAIL	AVAIL		AVAIL	
M610	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
800	NONE	NONE	NONE	NONE		NONE	NONE			
810	NONE	NONE	NONE	NONE		NONE	NONE			

schedules damper minimum position
4th floor only

Card 65---------- Heating Load Assignment ----------

Load Assignment Reference	All Coil Loads To Heating Ref	-Group 1- Begin	End	-Group 2- Begin	End	-Group 3- Begin	End	-Group 4- Begin	End	-Group 5- Begin	End	-Group 6- Begin	End	-Group 7- Begin	End	-Group 8- Begin	End	-Group 9- Begin	End
1	1	1	11																

Card 67---------- Heating Equipment Parameters ----------

Heat Ref Number	Equip Code Name	Number Of Units	HW Pmp Full Ld Value	Units	Cap'y Value	Units	Energy Rate Value	Units	Seq Order Number	Switch over Control	Hot Strg	Misc. Acc.	Cogen	Demand Limit Number
1	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF						
2	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF						
3	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF						

Card 69---------- Fan Equipment Parameters ----------

System Set Number	Cooling Fan	Heating Fan	Return Fan	Exhaust Fan	Auxiliary Supply	Room Exhaust	Optional Ventilation
1	EQ4001		EQ4004			SAMPLE-F	
2	EQ4001		EQ4004			SAMPLE-F	
3	EQ4001					SAMPLE-F	
4	EQ4280		EQ4904			SAMPLE-F	
5	EQ4001					SAMPLE-F	
6	EQ4001					SAMPLE-F	
7	EQ4280		EQ4904			SAMPLE-F	
8	EQ4001					SAMPLE-F	
9	EQ4001					SAMPLE-F	
10	EQ4001					SAMPLE-F	
11	EQ4000					EQ4000	

VSD's on AHUs 4 & 7 (4E & 4W) ——— and return fans

Card 70---------- Fan Equipment KW Overrides ----------

System Set Number	-----MAIN SYSTEM----- Cool Fan KW	Heat Fan KW	Ret Fan KW	Exh Fan KW	Aux Sup KW	--OTHER SYSTEM-- Room Exh KW	Opt Vent KW	----DEMAND LIMIT PRIORITY--- Cool Fan	Heat Fan	Aux Fan	Room Exh Fan	Opt Vent Fan
1	80		25									
2	80		25									
3	80											
4	100		13									
5	17											
6	33											
7	100		13									
8												
9												
10	16					60						
11												

Utility Description Reference Table

```
Schedules:
     A-DAMPER  4TH FLOOR DAMPER SCHEDULE
     A-L8HPD  LIGHTS 8HR/DA
     A-MODSKF  KIT FAN MOD SCH
     A-P8HPD  PEOPLE 8HR/DA
     AVAIL  AVAILABLE (100%)
     BLGBASE2  HOSPITAL BLG TEMPLATE HOT WATER SCHEDULE
     CL_76  COOLING TSTAT - CONST 76F
     HOTRLGT  HOTEL ROOMS LIGHTS
     HT_75  HEATING TSTAT - CONST 75F
     NONE  ANY PROJECT
     OFF  ALWAYS OFF
System:
     FC  FAN COIL
     FPVAV  FAN POWERED VAV
     PTAC  PACKAGED TERMINAL AIR COND.
     UV  UNIT VENTILATOR
     VRH  VARIABLE VOLUME REHEAT
Equipment:
     Cooling:
          EQ1001L   2-STG CENTRIFUGAL CHILLER >550 TONS
          EQ1120L  AIR-CLD RECIPROCATING > 22 TONS
          EQ1307  PACKAGED TERMINAL AIR CONDITIONER
          THRMCHHE  TRANE DIRECT FIRED ABSORBER, 1.07 COP
     Heating:
          EQ2002  GAS FIRED STEAM BOILER
     Fan:
          EQ4000  PREVENTS CONSUMPTION OF FAN ENERGY
          EQ4001  AIR FOIL CENTRIFUGAL - CONSTANT VOLUME
          EQ4004  AXIAL FLOW - CONSTANT VOLUME (MODEL Q)
          EQ4280  AIR FOIL FAN W\VARIABLE SPEED DRIVE
          EQ4904  VANE AXIAL FLOW FAN WITH VFD
          SAMPLE-F  SAMPLE GENERIC FAN
          Tower:
               EQ5100  COOLING TOWER FANS
       Misc:
          EQ5003  CHILLED WATER PUMP-VAV(SAME AS EQ5007)
```

Schedule Name: A-DAMPER
Project: 4TH FLOOR DAMPER SCHEDULE FOR MIN. POSITION
Location: EISENHOWER AMC
Client:
Program User:
Comments:

Starting Month: JAN Ending Month: DEC
Starting Day Type: DSGN Ending Day Type: WKDY

Hour	Util Percent
0	10
6	100
17	10
24	

Starting Month: JAN Ending Month: DEC
Starting Day Type: SAT Ending Day Type: SUN

Hour	Util Percent
0	10
24	

RS&H

SUBJECT
DESIGNER Hutchins
CHECKER
AEP NO
SHEET OF
DATE 3/8/96
DATE

ECO # HS18 Reduce Heated or Cooled Outside Air

Outside Air Flows

Measured

	Supply	OSA	% OSA	
4A	107,000	31,030	29	> avg 33%
4B	102,000	37,740	37	

Required (keeping existing supply air flows)

4A	107,000	24,100	22.5	> avg. 23%
4B	102,000	24,100	23.6	

CONSTRUCTION COST ESTIMATE

Project:	ECO # HS18 Reduce Heated or Cooled Outside Air	RS&H No.:	694-1331-005
Location:	Fort Gordon, GA.	Date:	3/9/96
Basis:	Schematic Design	Estimator:	P. HUTCHINS
Building:	Eisenhower Army Medical Center	Filename:	EST_HS18.XLS

ITEM DESCRIPTION	QUANTITY No.	Unit	MATERIAL/EQUIP $/Unit	Total	LABOR $/Unit	Total	TOTAL COST	SOURCE Material	Labor
Balance AHU	2	ea		$0	$507.00	$1,014	$1,014		MMp332
This estimate includes overhead and profit									
Subtotal Bare Costs				$0		$1,014	$1,014		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$0		$1,014	$1,014		
City Cost Index (Aug. GA)			0%	$0	0%	$0	$0	MMp533	MMp533
				-		-	-		
Subtotal				$0		$1,014	$1,014		
OH & Profit Markups			10%	$0	0%	$0	$0	MMp7	MMp475
				-		-	-		
Subtotal				$0		$1,014	$1,014		
Sales Taxes			6.0%	$0		NA	$0	MMp476	
				-		-	-		
Subtotal				$0		$1,014	$1,014		
Contingency			10%	$0	10%	$101	$101	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$0		$1,115	$1,115		
Design Fee				NA	0.0%	$0	$0		
SIOH				NA	6.0%	$61	$61		
				-		-	-		
Total Project Cost				$0		$1,176	$1,176		

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###.
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###
Dp###	2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: HS18
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-HS18 REDUCE HEATED & COOLED OUTSIDE AIR
FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 1100.	
B. SIOH	$ 66.	
C. DESIGN COST	$ 66.	
D. TOTAL COST (1A+1B+1C)	$ 1232.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 1232.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	136.	$ 1036.	13.68	$ 14177.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	32.	$ 86.	17.25	$ 1490.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		168.	$ 1123.		$ 15667.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) — $ 0.
(1) DISCOUNT FACTOR (TABLE A) — 12.90
(2) DISCOUNTED SAVING/COST (3A X 3A1) — $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 1123.

5. SIMPLE PAYBACK PERIOD (1G/4) — 1.10 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) — $ 15667.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= — 12.72
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): — 18.78 %

****
****
**
**
**
**
**
**
**
**
**
**
**
**
****
****

TRACE 600 ANALYSIS

by C.D.S. MARKETING

EISENHOWER ARMY MEDICAL CENTER
AUGUSTA, GA
SAVANNAH DISTRICT CORPS OF ENGINEERS
REYNOLDS, SMITH & HILLS
OSA REDUCTION ECO # HS18

Weather File Code:	AUGUSTA	
Location:		
Latitude:	33.0	(deg)
Longitude:	82.0	(deg)
Time Zone:	5	
Elevation:	143	(ft)
Barometric Pressure:	29.8	(in. Hg)
Summer Clearness Number:	0.90	
Winter Clearness Number:	0.90	
Summer Design Dry Bulb:	95	(F)
Summer Design Wet Bulb:	76	(F)
Winter Design Dry Bulb:	23	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0756	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	1.1094	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,883.6	(Btu-min./hr/cuft)
Enthalpy Factor:	4.5387	(Lb-min./hr/cuft)

Design Simulation Period: July To July
System Simulation Period: January To December
Cooling Load Methodology: CEC-DOE2/Exact TFM method with CEC\DOE 2.1c constraints

Time/Date Program was Run: 19:10:44 6/26/96
Dataset Name: OSA .TM

ENERGY SAVINGS

ELC (kwh)	NGAS (therms)
22,118,931	622,460
22,078,960	622,137
39,971	323
136 MBTU	32 MBTU

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	1,552,783	2,740	78,233	2,094	188
Feb	1,377,334	2,738	73,339	1,865	188
March	1,691,412	2,829	60,151	2,212	184
April	1,807,434	2,969	45,542	2,451	164
May	1,974,632	3,376	41,192	2,855	158
June	2,160,054	3,620	35,747	3,503	152
July	2,261,782	3,615	37,878	3,738	154
Aug	2,243,318	3,661	37,848	3,722	155
Sept	2,014,967	3,506	39,112	3,053	157
Oct	1,744,879	2,901	52,382	2,200	169
Nov	1,633,376	2,876	55,065	2,051	180
Dec	1,616,987	2,767	65,648	2,055	187
Total	22,078,960	3,661	622,137	31,800	188

Building Energy Consumption = 187,797 (Btu/Sq Ft/Year) Floor Area = 732,541 (Sq Ft)
Source Energy Consumption = 398,035 (Btu/Sq Ft/Year)

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

UTILITY PEAK CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 3,661.3 (kW)
Yearly Time of Peak 18 (hr) 8 (mo)

Hour 18 Month 8

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	753.4	20.58
2	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	596.0	16.28
4	EQ1307	PACKAGED TERMINAL AIR CONDITIONER	26.8	0.73
5	EQ1120L	AIR-CLD RECIPROCATING > 22 TONS	63.5	1.74
Sub Total			1,439.6	39.32
Heating Equipment				
1	EQ2002	GAS FIRED STEAM BOILER	56.0	1.53
Sub Total			56.0	1.53
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	102.3	2.79
2		SUMMATION OF FAN ELECTRICAL DEMAND	102.1	2.79
3		SUMMATION OF FAN ELECTRICAL DEMAND	82.8	2.26
4		SUMMATION OF FAN ELECTRICAL DEMAND	115.9	3.16
5		SUMMATION OF FAN ELECTRICAL DEMAND	21.5	0.59
6		SUMMATION OF FAN ELECTRICAL DEMAND	34.7	0.95
7		SUMMATION OF FAN ELECTRICAL DEMAND	117.4	3.21
8		SUMMATION OF FAN ELECTRICAL DEMAND	1.5	0.04
9		SUMMATION OF FAN ELECTRICAL DEMAND	8.4	0.23
10		SUMMATION OF FAN ELECTRICAL DEMAND	76.0	2.08
Sub Total			662.6	18.10
Sub Total			0.0	0.00
Miscellaneous				
Lights			732.6	20.01
Base Utilities			0.0	0.00
Misc Equipment			770.6	21.05
Sub Total			1,503.1	41.05
Grand Total			3,661.3	100.00

HS18-6

CALIFORNIA TITLE 24 COMPLIANCE - ALTERNATIVE 1

CALIFORNIA TITLE 24 COMPLIANCE REPORT

Weather Name ..... AUGUSTA
Gross Conditioned Floor Area (sqft)..... 732,541
ACM Multiplier 1.025

E N E R G Y U S E S U M M A R Y

	ELEC (kWh/yr)	GAS (kBtu/yr)	WATER (1000 gal)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	141,955.8	35,274,828.0	385.9	26.0	38,585,028.0	54.0
Primary Cooling						
Compressor	2,713,409.7	0.0	0.0	6.7	27,785,380.0	38.9
Tower/Cond Fans	536,170.3	0.0	31,119.7	1.3	5,490,396.0	7.7
Condenser Pump	1,005,827.2	0.0	0.0	2.5	10,299,695.0	14.4
Other Accessories	814,772.4	0.0	0.0	2.0	8,343,289.0	11.7
Auxiliary						
Supply Fans	5,549,719.5	0.0	0.0	13.8	56,829,260.0	79.5
Circulation Pumps	673,572.5	0.0	0.0	1.7	6,897,398.5	9.7
Base Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	6,223,292.0	0.0	0.0	15.4	63,726,656.0	89.2
Lighting	5,344,352.5	0.0	0.0	13.3	54,726,296.0	74.7
Receptacle	5,299,176.5	0.0	0.0	13.1	54,263,692.0	74.1
Domestic Hot Water	0.0	26,938,826.0	294.7	19.6	28,356,660.0	38.7
Cogeneration	0.0	0.0	0.0	0.0	0.0	0.0
Totals	22,078,956.0	62,213,656.0	31,800.3	100.0	291577088.0	403.3

01 Card - Job Information

Project: EISENHOWER ARMY MEDICAL CENTER
Location: AUGUSTA, GA
Client: SAVANNAH DISTRICT CORPS OF ENGINEERS
Program User: REYNOLDS, SMITH & HILLS
Comments: OSA REDUCTION

Card 08---------- Climatic Information ----------

Weather Code	Summer Clearness Number	Winter Clearness Number	Summer Design Dry Bulb	Summer Design Wet Bulb	Winter Design Dry Bulb	Building Orientation	Summer Ground Reflect	Winter Ground Reflect
AUGUSTA								

Card 09---------- Load Simulation Periods ----------

1st Month Cooling Simulation	Last Month Cooling Simulation	Peak Cooling Load Hr	1st Month Summer Period	Last Month Summer Period	1st Month Daylight Savings	Last Month Daylight Savings
JUL	JUL					

Card 10---------- Load Simulation Parameters ----------

Cooling Load Method	Heating Load Method	Ventilation Method	Airflow Input Units	Airflow Output Units	Room Circulation Rate	Put Wall RA Load to Room
CEC-DOE2	CEC-DOE2					

Card 11---------- Energy Simulation Parameters ----------

1st Month Energy Simulation	Last Month Energy Simulation	Level Of Calculation	Holiday Code	Calendar Code	Building Floor Area
JAN	DEC	ZONE		2001	

---------- Load Section Alternative #1 ----------

Card 19- Load Alternative -

Number	Description
1	BASELINE

Card 27---------- People and Lights ----------

Room Number	People Value	People Units	People Sensible	People Latent	Lighting Value	Lighting Units	Lighting Fixture Type	Ballast Factor	Percent Lights to Ret. Air	--- Daylighting --- Reference Point 1	Reference Point 2
M	309	SF-PERS	250	200	1.125	WATT-SF	RECFL-RS		75		
160					2.625						
170					2.625						
180					2.625						
190	0	SF-PERS									
240	0	SF-PERS									
350	0	SF-PERS									
400	200	SF-PERS			2.025	WATT-SF					
410	200	SF-PERS			2.025	WATT-SF					
420	200	SF-PERS			2.025	WATT-SF					
430	200	SF-PERS			2.025	WATT-SF					
440	200	SF-PERS			2.025	WATT-SF					
800	0	SF-PERS									
810	0	SF-PERS									
M900	150	SF-PERS			0	WATT-SF					

Card 28---------- Miscellaneous Equipment ----------

Room Number	Misc Equipment Number	Equipment Descrip	Energy Consump Value	Energy Consump Units	Schedule Code	Energy Meter Code	Percent of Load Sensible	Percent Misc. Load to Room	Percent Misc. Sens to Ret. Air	Radiant Fraction	Optional Air Path
M	1	MISC EQUIP	1.08	WATT-SF	A-L8HPD	ELEC					
160	1	MISC EQUIP	5.00	WATT-SF	AVAIL	ELEC					
170	1	MISC EQUIP	5.00	WATT-SF	AVAIL	ELEC					
180	1	MISC EQUIP	5.00	WATT-SF	AVAIL	ELEC					
250	1	MISC EQUIP	3.00	WATT-SF	A-L8HPD	ELEC					
M900	1	MISC ELEC	1.	WATT-SF	HOTRLGT	NONE					

Card 29---------- Room Airflows ----------

Room Number	Ventilation --- Cooling --- Value	Units	Heating --- Value	Units	Infiltration --- Cooling --- Value	Units	Heating --- Value	Units	Reheat Minimum --- Value	Units
M100	19	PCT-MCLG	19	PCT-MCLG	0	ACH-HR	0	ACH-HR	100	PCT-MCLG
M210	19	PCT-MCLG	19	PCT-MCLG	0.75	ACH-HR	0.75	ACH-HR	100	PCT-MCLG
302	100	PCT-MCLG	100	PCT-MCLG					100	PCT-MCLG
330	100	PCT-MCLG	100	PCT-MCLG					100	PCT-MCLG
332	100	PCT-MCLG	100	PCT-MCLG	0	ACH-HR	0	ACH-HR	100	PCT-MCLG
334	100	PCT-MCLG	100	PCT-MCLG	0	ACH-HR	0	ACH-HR	100	PCT-MCLG
M400	23	PCT-MCLG	23	PCT-MCLG	0.25	ACH-HR	0.25	ACH-HR	100	PCT-MCLG
M510	100	PCT-MCLG	100	PCT-MCLG					100	PCT-MCLG
M620	23	PCT-MCLG	23	PCT-MCLG	0.25	ACH-HR	0.25	ACH-HR	100	PCT-MCLG
800	0	CFM	0	CFM	0	CFM	0	CFM		
810	0	CFM	0	CFM	0	CFM	0	CFM		
M900	15	PCT-MCLG	15	PCT-MCLG	0.50	ACH-HR	0.50	ACH-HR	100	PCT-MCLG

OSA reduced on all levels except kitchen make up, OR & ICU

RS&H

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER _____ DATE _____

CHECKER _____ DATE _____

ASHRAE 62-89 Calculation

Requirements	cfm per person
Patient Rooms	25
Medical Procedure	15
Operating Rooms	30
Recovery and ICU	15
Offices	20

Peak hospital occupancy is 2000

Nighttime 400

Assume 300 in-room patients

SF	AREA	PEOPLE	IN-ROOM PATIENTS	OSA
1	88,400	240		4800
2	120,000	340		6800
3	97,000	260		5200
4A	128,525	350	150	10,750
4B	129,295	350	150	10,750
5	14,730	20	10	450
6	20,000	20	30	1500
MRI	2940	10		200
FAM PRT.	25,976	70		1400
TOTAL	626,866	1660	340	

RS&H

SUBJECT FORT GORDON - EAMC
SCHEDULED SETBACK FOR OR
DESIGNER W. TODD
CHECKER

AEP NO 694 1268 005
SHEET ____ OF ____
DATE 3-7-96
DATE

ECO-HS24 SETBACK SUPPLY AIR TO SURGICAL SUITE

The surgical suite is not typically utilized at night and on weekends. This project will allow the supply and exhaust fans to operate at a reduced capacity during unoccupied times.

This area is served by: (Info from design dwgs.)

SF-6, 27900 cfm supply, 40 hp motor

EF-6, 22900 cfm exhaust, 5 hp motor

Funded Renovation Includes:

- VFD's on SF-6 and EF-6 motors
- Day/night setback software
- Speed control for fans
- Start/stop for fans, time control
- Current transformers on fan motors
- Alarm for fan status

OR Design Requirements: (see pages HS24-6, 7, 8 & 9)

- 15 Air changes per hour supply air (occupied)
- 5 " " " " outside " "
- 68 to 76 °F, 50-60% RH
- 3 Air changes per hour supply air (unoccupied)

Existing estimated supply air = 8.25 AC/HR

RS&H

SUBJECT FORT GORDON - EAMC
SCHEDULED SETBACK FOR OR
DESIGNER W. TODD
CHECKER

AEP NO 694 1331 005
SHEET OF
DATE 3-7-96
DATE

ECO-HS24 (Continued)

Design pos. pressure = $\frac{27900 - 22900}{27900} = 0.179$

Minimum Supply Air = 3 AC per hour

Minimum Flow required = $\frac{3 \text{ AC/HR}}{8.25 \text{ AC/HR}} = 0.36 \Rightarrow$ say 40%

Fan operating hours:

- Assume surgical suite is occupied from 6am to 9pm, 5 days/week.
- Assume fans will operate at 100% for a total of 1 hour from 9pm - 6am, M-F.
- Assume fans will operate at 100% for 12 hours/day during weekends.

100% op. hrs = $(15+1)\frac{hr}{day} \times 5\frac{day}{wk} + 12\frac{hr}{day} \times 2\frac{day}{wk} = 104\ ^{hr}/_{wk}$

40% op. hrs. = $8\frac{hr}{day} \times 5\frac{day}{wk} + 12\frac{hr}{day} \times 2\frac{day}{wk} = 64\ ^{hr}/_{wk}$

Energy Savings: See pages HS24-3 and HS24-4

Elec. Savings = $102426\frac{kwh}{YR} + 13018\frac{kwh}{YR} = 115444\frac{kwh}{YR}$

$115444\frac{kwh}{YR} \times 3413\frac{Btu}{kwh} \times \frac{1\text{ mBtu}}{10^6\text{ Btu}} = 394\ ^{mBtu}/_{YR}$

This is a simple hand calc. Computer simulation results are used for final analysis (p. HS24-11).

Variable Frequency Drive Preliminary Analysis 03/06/96
Filename: ECO-HSX.WB2
Application: Fort Gordon Hospital, 4th Floor

Motor bhp : 40 bhp
Motor Eff.: 91.0 %
Oper Hours: 8760 Hours/Year
Elec. Rate: $0.026 /kWh

Exist. Control : N/C
New Control: VFD

Oper Hr/Wk	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER N/C	DMPR	VIV	VFD	HORSEPOWER * HOURS N/C	DMPR	VIV	VFD
104.0	0.62	100%	40.00	40.00	40.00	40.00	216,914	216,914	216,914	216,914
0.0	0.00	90%	40.00	38.80	34.00	29.16	0	0	0	0
0.0	0.00	80%	40.00	38.00	28.00	20.48	0	0	0	0
0.0	0.00	70%	40.00	36.00	26.00	13.72	0	0	0	0
0.0	0.00	60%	40.00	34.00	24.00	8.64	0	0	0	0
0.0	0.00	50%	40.00	32.00	22.00	5.00	0	0	0	0
64.0	0.38	40%	40.00	30.00	20.00	2.56	133,486	100,114	66,743	8,543
168.0	1.00				Totals		350,400	317,029	283,657	225,457

	Energy Use		Energy Cost	
N/C = No Control	287,251	kWh/Yr	$7,469	/Yr
DMPR = Outlet Damper	259,894	kWh/Yr	$6,757	/Yr
VIV = Vari. Inlet Vane	232,537	kWh/Yr	$6,046	/Yr
VFD = Vari. Freq. Drive	184,825	kWh/Yr	$4,805	/Yr

Annual Savings for: VFD vs N/C

Energy Savings =	102,426	kWh/Year
Cost Savings =	$2,663	/Year

Notes:
1. Equation for VFD HP is: HP2 = (Q2/Q1)^3 x HP1
2. Q = volume air flow, cfm

Variable Frequency Drive Preliminary Analysis 03/06/96
Filename: ECO-HSX.WB2
Application: Fort Gordon Hospital, 4th Floor

Motor bhp:	5 bhp	Exist. Control :	N/C
Motor Eff.:	89.5 %	New Control:	VFD
Oper Hours:	8760 Hours/Year		
Elec. Rate:	$0.026 /kWh		

Oper Hr/Wk	%Oper Hours	%Flow Req'd	INPUT HORSEPOWER N/C	DMPR	VIV	VFD	HORSEPOWER * HOURS N/C	DMPR	VIV	VFD
104.0	0.62	100%	5.00	5.00	5.00	5.00	27,114	27,114	27,114	27,114
0.0	0.00	90%	5.00	4.85	4.25	3.65	0	0	0	0
0.0	0.00	80%	5.00	4.75	3.50	2.56	0	0	0	0
0.0	0.00	70%	5.00	4.50	3.25	1.71	0	0	0	0
0.0	0.00	60%	5.00	4.25	3.00	1.08	0	0	0	0
0.0	0.00	50%	5.00	4.00	2.75	0.63	0	0	0	0
64.0	0.38	40%	5.00	3.75	2.50	0.32	16,686	12,514	8,343	1,068
168.0	1.00				Totals		43,800	39,629	35,457	28,182

	Energy Use		Energy Cost	
N/C = No Control	36,508	kWh/Yr	$949	/Yr
DMPR = Outlet Damper	33,031	kWh/Yr	$859	/Yr
VIV = Vari. Inlet Vane	29,554	kWh/Yr	$768	/Yr
VFD = Vari. Freq. Drive	23,490	kWh/Yr	$611	/Yr

Annual Savings for: VFD vs N/C

Energy Savings =	13,018	kWh/Year
Cost Savings =	$338	/Year

Notes:
1. Equation for VFD HP is: HP2 = (Q2/Q1)^3 x HP1
2. Q = volume air flow, cfm

HS 24-4

CONSTRUCTION COST ESTIMATE

Project: ECO-HS24, Scheduling Controls for SF-6 & EF-5
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 03/06/96
Estimator: W. T. Todd
Filename: est-hs24.wb2

ITEM DESCRIPTION	QUANTITY No.	Unit	MATERIAL $/Unit	Total	LABOR $/Unit	Total	TOTAL COST	SOURCE Material	Labor
DDC Controls:									
Setback schedule for fans									
Engineering labor	2	Pt		0	49.68	99	99	MMp318	MMp318
Calibration labor	2	Pt		0	49.68	99	99	MMp318	MMp318
Start-up & chkout labor	2	Pt		0	75.18	150	150	MMp318	MMp318
Set VFDs for minimum flo									
Engineering labor	2	Pt		0	49.68	99	99	MMp318	MMp318
Calibration labor	2	Pt		0	49.68	99	99	MMp318	MMp318
Start-up & chkout labor	2	Pt		0	75.18	150	150	MMp318	MMp318
Manual overide inputs									
Engineering labor	2	Pt		0	49.68	99	99	MMp318	MMp318
Calibration labor	2	Pt		0	49.68	99	99	MMp318	MMp318
Start-up & chkout labor	2	Pt		0	75.18	150	150	MMp318	MMp318
Hand/Off/Auto switch	1	Ea	57	57	38	38	95	MEp195	MEp195
Wire, copper, 600 V, #12	6	CLF	5.9	35	21.5	129	164	MEp144	MEp144
Conduit, 1/2" EMT	200	LF	0.3	60	0.54	108	168	MEp105	MEp105
Subtotal Bare Costs				152		1319	$1,471		
Retrofit Cost Factors			0%	0	0%	0	0	MMp6	MMp6
Subtotal				152		1319	1,471		
City Cost Index (Aug. GA)			0%	0	-46%	-607	(607)	MMp533	MMp533
Subtotal				152		712	864		
OH & Profit Markups			10%	15	53%	377	392	MMp7	MMp475
Subtotal				167		1089	1,256		
Sales Taxes			6.0%	10		NA	10	MMp476	
Subtotal				177		1089	1,266		
Contingency			10%	18	10%	109	127	MMp6	MMp6
Total Construction Cost				195		1198	1,393		
Design Fee				NA	6.0%	84	84		
SIOH				NA	6.0%	84	84		
Total Project Cost				195		1366	$1,561		

LEGEND:
MEp### 1996 Means Electrical Cost Data, page ###.
MMp### 1996 Means Mechanical Cost Data, page ###.

MILITARY HANDBOOK

DEPARTMENT OF DEFENSE

MEDICAL AND DENTAL TREATMENT FACILITIES

DESIGN AND CONSTRUCTION CRITERIA

AMSC N/A

AREA FACR

APPENDIX A
ARCHITECTURAL AND ENGINEERING DESIGN REQUIREMENTS

ROOM CODE	ROOM NAME	ARCHITECTURAL FINISHES				DOORS		ACOUSTICAL		FLR LD		ELECTRICAL	
		FLOOR	BASE	WALL	CEILING	C'LG HT	SIZES	NOISE LEVEL IN RM	STC	PSF kPa	ILL fc	EMERG POWER	
OPST1	OUTPAT STRESS TESTING	VCT	R	GWP	ACT1	9'-0" 2750mm	3'-6" 1050mm	35-40	50	60 2.9	50	***	
OPSW1	OPTICAL SVC WORK AREA	VCT	R	GWP	ACT1	8'-0" 2400mm	3'-0" 900mm	30-35	40	60 2.9	100	***	
OPTM1	OUTPAT TREADMILL ROOM	VCT	R	GWP	ACT1	9'-0" 2750mm	3'-6" 1050mm	35-40	50	60 2.9	50	***	
OPVC1	OUTPAT VECTORCARDIO	VCT	R	GWP	ACT1	8'-0" 2400mm	3'-0" 900mm	30-35	40	60 2.9	50	***	
OPVL1	OUTPAT VASCULAR LAB	SV	R	GWL	ACT1	8'-0" 2400mm	3'-0" 900mm	30-35	40	60 2.9	50G 100	***	
ORCH1	OR CARDIAC MONITORING	SV	IV	GWL	ACT1	10'-0" 3000mm	4'-0" 1200mm	30-35	40	60 2.9	200 M;E	LB;RA	
ORCS1	OR CYSTOSCOPIC SURGERY	FT/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	30-35	45	60 2.9	200 M;E	LB;RA	
ORCT1	OR CARDIOTHORACIC SURG	FT/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	30-35	45	60 2.9	200 M;E	LB;RA	
ORCW1	OR CLEAN WORK	FT/ SV	CT/ IV	CT/ GWL	GWL	9'-0" 2750mm	3'-0" 900mm	30-35	45	60 2.9	100 M	L;R	
ORDA1	OR DECONTAMINATION	CT/ SV	CT/ IV	CT/ GWL	GWL	9'-0" 2750mm	3'-0" 900mm	30-35	45	60 2.9	30	L;R	
OREC1	OR EQUIPMENT CLEANUP	VCT/ SV	R/ IV	CT/ GWL	GWL	9'-0" 2750mm	3'-6" 1050mm	30-35	45	60 2.9	30	L;R	
ORGS1	OR GENERAL SURGERY	FT/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	30-35	45	60 2.9	200 M;E	LB;RA	
ORHL1	OR HEART LUNG PUMP	FT/ SV	CT/ IV	CT/ GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	***	***	60 2.9	20	LS	
ORNE1	OR NEUROSURG EQ STOR	SV	IV	GWL	GWL	10'-0" 3000mm	4'-0" 1200mm	***	***	125 6.0	20	LS	

APPENDIX A
ARCHITECTURAL AND ENGINEERING DESIGN REQUIREMENTS

L CASES

xygen MV-Med Vac MA-Med Air NO-Nitrous Oxide
itrogen CA-Gas DA-Dental Air OE-Oral Evac
ab Air PA-Process Air LV-Lab Vac.

INTERIOR MECHANICAL DESIGN CONDITIONS

			1	2	3	4		5		6	7	
			AIR	AIR	MIN	TEMP		REL		FILTRATION		
		NOTES	BAL	CHG	OA	SUM	WIN	HUM	PRE	FIN	EXH	NOTES
1MV 1MA		3	0	4	2	78F 26C	70F 21C	***	25%	***	***	
			0	4	1	78F 26C	68F 20C	***	25%	***	***	
1MV 1MA		3	0	4	2	78F 26C	70F 21C	***	25%	***	***	
1MV 1MA		3	0	4	2	78F 26C	68F 20C	***	25%	***	***	
1MV 1MA		3	-	4	2	78F 26C	70F 21C	***	25%	***	***	
4MV 2MA		3	0	6	2	78F 24C	70F 20C	***	25%	90%	***	
3MV 1MA 1NO		5	++	15	5	68-76F 20-24C		50-60	25%	90%		8 21
7MV 4MA 2NO 2NI	---	5,7	++	15	5	68-76F 20-24C		50-60	25%	99.97%		8 21
			+	6	2	75F 24C	—	***	25%	90%	***	
1MV 1MA 1NI		10	—	10	2.5	75F 24C	—	***	25%	90%	YES	17
1MV 1MA 1NI		10	+	6	2	75F 24C	—	***	25%	***	YES	
7MV 4MA 2NO 2NI		5,7	++	15	5	68-76F 20-24C		50-60	25%	90%		8 21
			++	15	5	68-76F 20-24C		50-60	25%	99.97%		8 21
			+	6	1.5	75F 24C	—	***	25%	90%	***	

INTERIOR MECHANICAL DESIGN CONDITIONS
FOR SPECIFIC AREAS, MEDICAL AND DENTAL TREATMENT FACILITIES (continued):

Relative Humidity (RH). This is the relative humidity to be maintained in a space as part of the designed conditions. The humidity may vary from 30 percent to 60 percent except where other design values are given or where there is no requirement for humidity control. Specific summer RH control is not required except for those areas provided under specific notes. Winter RH control is not required except as provided under notes.

Filtration. Up to three filter types may be required. The Orthopedic Operating Room requires a 25 percent prefilter, a 90 percent intermediate filter, and a 99.97 percent final filter. The values for the first two filters (see Appendix A) are by the atmospheric dust spot efficiency test. The atmospheric dust spot efficiencies are the minimum average and are based on ASHRAE Standard 52-76. The third filter where required is a HEPA filter which uses the DOP (Dy-Octyl Phthalate, or bis(2-ethylhexyl phthalate) test method. The DOP test efficiency is based on MIL-STD 282. All filters should be installed to prevent leakage between the filter segments and between the filter and its supporting frame.

7. Exhaust Outside. This column lists areas that require 100% exhaust directly to the outside.

8. Air supply shall be 15 air changes per hour unless a higher rate is required to meet cooling requirement and may be totally exhausted when the room is in use. The option as whether to utilize recirculated air during an operation is left to the discretion of the individual Military Departments. Should recirculated air be utilized the minimum outside air requirements would apply. During period of non-use, either (1) 75% of the air may be recirculated or (2) the air volume may be reduced to 3 air changes per hour, while maintaining the required air balance. All systems shall, if cost effective, use exhaust air energy recovery to precondition the incoming outside air.

9. Room exhaust directly over patient stations.

10. For negative isolation, room shall be negative to anteroom and positive to toilet. For positive isolation, room shall be positive to both anteroom and toilet. Anteroom shall be negative to corridor at all times. For isolation room used for patients with a high susceptability to infection from leukemia, burns, bone marrow transplant, organ transplant, or Acquired Immunodeficiency Syndrome, HEPA should be used on air supply system.

11. Exhaust all to outside applicable to process only.

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: HS24
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-HS24 SURGICAL SUITE SUPPLY AIR RESET
FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 06-30-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 1400.		
B. SIOH	$ 84.		
C. DESIGN COST	$ 84.		
D. TOTAL COST (1A+1B+1C)	$ 1568.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.		
F. PUBLIC UTILITY COMPANY REBATE	$ 0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 1568.	

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	738.	$ 5624.	13.68	$ 76930.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	1984.	$ 5357.	17.25	$ 92405.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		2722.	$ 10980.		$ 169335.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)	$ 0.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))	$ 10980.
5. SIMPLE PAYBACK PERIOD (1G/4)	.14 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	$ 169335.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= (IF < 1 PROJECT DOES NOT QUALIFY)	107.99
8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	32.19 %

****
****
**
** TRACE 600 ANALYSIS **
**
** by C.D.S. MARKETING **
**
****
****

EISENHOWER ARMY MEDICAL CENTER
AUGUSTA, GA
SAVANNAH DISTRICT CORPS OF ENGINEERS
REYNOLDS, SMITH & HILLS
SCHEDULE OR AHU

ECO # HS24 Reset Surgical Suite Supply Air

Weather File Code:	AUGUSTA	
Location:		
Latitude:	33.0	(deg)
Longitude:	82.0	(deg)
Time Zone:	5	
Elevation:	143	(ft)
Barometric Pressure:	29.8	(in. Hg)
Summer Clearness Number:	0.90	
Winter Clearness Number:	0.90	
Summer Design Dry Bulb:	95	(F)
Summer Design Wet Bulb:	76	(F)
Winter Design Dry Bulb:	23	(F)
Summer Ground Relectance:	0.20	
Winter Ground Relectance:	0.20	
Air Density:	0.0756	(Lbm/cuft)
Air Specific Heat:	0.2444	(Btu/lbm/F)
Density-Specific Heat Prod:	1.1094	(Btu-min./hr/cuft/F)
Latent Heat Factor:	4,883.6	(Btu-min./hr/cuft)
Enthalpy Factor:	4.5387	(Lb-min./hr/cuft)

ENERGY SAVINGS

	ELC (kwh)	NGAS (therms)
	22,118,931	622,460
	21,902,632	602,620
	216,299	19,840
	738 MBTU	1984 MBTU

Design Simulation Period: July To July
System Simulation Period: January To December
Cooling Load Methodology: CEC-DOE2/Exact TFM method with CEC\DOE 2.1c constraints

Time/Date Program was Run: 22:21:39 6/26/96
Dataset Name: SSFSCH .TM

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1

MONTHLY ENERGY CONSUMPTION

Month	ELEC On Peak (kWh)	DEMAND On Peak (kW)	GAS On Peak (Therm)	WATER (1000 Gl)	GAS DMND On Peak (Thrm/hr)
Jan	1,534,644	2,727	73,603	1,961	188
Feb	1,361,771	2,724	69,495	1,760	188
March	1,671,263	2,818	58,066	2,122	183
April	1,786,361	2,967	44,747	2,381	164
May	1,956,230	3,359	40,719	2,821	157
June	2,152,261	3,629	35,426	3,524	152
July	2,256,475	3,624	37,535	3,765	154
Aug	2,238,842	3,649	37,508	3,744	155
Sept	2,009,003	3,491	38,731	3,040	157
Oct	1,724,218	2,895	50,823	2,120	169
Nov	1,614,096	2,851	53,252	1,976	179
Dec	1,597,469	2,755	62,715	1,949	186
Total	21,902,632	3,649	602,620	31,164	188

Building Energy Consumption = 184,311 (Btu/Sq Ft/Year) Floor Area = 732,541 (Sq Ft)
Source Energy Consumption = 392,766 (Btu/Sq Ft/Year)

HS24-12

UTILITY PEAK CHECKSUMS - ALTERNATIVE 1

UTILITY PEAK CHECKSUMS

Utility ELECTRIC DEMAND

Peak Value 3,648.6 (kW)
Yearly Time of Peak 18 (hr) 8 (mo)

Hour 18 Month 8

Eqp. Ref. Num.	Equipment Code Name	Equipment Description	Utility Demand (kW)	Percnt Of Tot (%)
Cooling Equipment				
1	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	758.0	20.77
2	EQ1001L	2-STG CENTRIFUGAL CHILLER >550 TONS	600.6	16.46
4	EQ1307	PACKAGED TERMINAL AIR CONDITIONER	26.8	0.73
5	EQ1120L	AIR-CLD RECIPROCATING > 22 TONS	63.5	1.74
Sub Total			1,448.9	39.71
Heating Equipment				
1	EQ2002	GAS FIRED STEAM BOILER	56.0	1.53
Sub Total			56.0	1.53
Air Moving Equipment				
1		SUMMATION OF FAN ELECTRICAL DEMAND	102.3	2.80
2		SUMMATION OF FAN ELECTRICAL DEMAND	102.1	2.80
3		SUMMATION OF FAN ELECTRICAL DEMAND	82.8	2.27
4		SUMMATION OF FAN ELECTRICAL DEMAND	115.9	3.18
5		SUMMATION OF FAN ELECTRICAL DEMAND	21.5	0.59
6		SUMMATION OF FAN ELECTRICAL DEMAND	12.8	0.35
7		SUMMATION OF FAN ELECTRICAL DEMAND	117.4	3.22
8		SUMMATION OF FAN ELECTRICAL DEMAND	1.5	0.04
9		SUMMATION OF FAN ELECTRICAL DEMAND	8.4	0.23
10		SUMMATION OF FAN ELECTRICAL DEMAND	76.0	2.08
Sub Total			640.6	17.56
Sub Total			0.0	0.00
Miscellaneous				
Lights			732.6	20.08
Base Utilities			0.0	0.00
Misc Equipment			770.6	21.12
Sub Total			1,503.1	41.20
Grand Total			3,648.6	100.00

HS24-13

CALIFORNIA TITLE 24 COMPLIANCE REPORT

Weather Name ..... AUGUSTA
Gross Conditioned Floor Area (sqft)..... 732,541
ACM Multiplier 1.025

ENERGY USE SUMMARY

	ELEC (kWh/yr)	GAS (kBtu/yr)	WATER (1000 gal)	PERCENT OF TOTAL ENERGY (%)	TOTAL SOURCE ENERGY (kBtu/yr)	ADJUSTED UNIT SOURCE ENERGY (kBtu/yr-sf)
Primary Heating	141,955.8	33,323,140.0	376.4	25.0	36,530,620.0	51.1
Primary Cooling						
Compressor	2,690,901.3	0.0	0.0	6.8	27,554,892.0	38.6
Tower/Cond Fans	537,923.1	0.0	30,483.0	1.4	5,508,345.5	7.7
Condenser Pump	1,017,137.0	0.0	0.0	2.6	10,415,507.0	14.6
Other Accessories	815,767.1	0.0	0.0	2.1	8,353,474.0	11.7
Auxiliary						
Supply Fans	5,378,677.0	0.0	0.0	13.6	55,077,780.0	77.1
Circulation Pumps	676,739.2	0.0	0.0	1.7	6,929,826.0	9.7
Base Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	6,055,416.0	0.0	0.0	15.3	62,007,604.0	86.8
Lighting	5,344,352.5	0.0	0.0	13.5	54,726,296.0	74.7
Receptacle	5,299,176.5	0.0	0.0	13.4	54,263,692.0	74.1
Domestic Hot Water	0.0	26,938,838.0	304.3	20.0	28,356,672.0	38.7
Cogeneration	0.0	0.0	0.0	0.0	0.0	0.0
Totals	21,902,628.0	60,261,976.0	31,163.7	100.0	287717088.0	397.9

01 Card - Job Information

Project: EISENHOWER ARMY MEDICAL CENTER
Location: AUGUSTA, GA
Client: SAVANNAH DISTRICT CORPS OF ENGINEERS
Program User: REYNOLDS, SMITH & HILLS
Comments: SCHEDULE OR AHU

Card 08---------- Climatic Information ----------

Weather Code	Summer Clearness Number	Winter Clearness Number	Summer Design Dry Bulb	Summer Design Wet Bulb	Winter Design Dry Bulb	Building Orientation	Summer Ground Reflect	Winter Ground Reflect
AUGUSTA								

Card 09---------- Load Simulation Periods ----------

1st Month Cooling Simulation	Last Month Cooling Simulation	Peak Cooling Load Hr	1st Month Summer Period	Last Month Summer Period	1st Month Daylight Savings	Last Month Daylight Savings
JUL	JUL					

Card 10---------- Load Simulation Parameters ----------

Cooling Load Method	Heating Load Method	Ventilation Method	Airflow Input Units	Airflow Output Units	Room Circulation Rate	Put Wall RA Load to Room
CEC-DOE2	CEC-DOE2					

Card 11--------- Energy Simulation Parameters ----------

1st Month Energy Simulation	Last Month Energy Simulation	Level Of Calculation	Holiday Code	Calendar Code	Building Floor Area
JAN	DEC	ZONE		2001	

---------- Load Section Alternative #1 ----------

Card 19- Load Alternative -

Number	Description
1	BASELINE

HS24-15

Card 25---------- Wall/Glass Parameters ----------

Room Number	Wall Number	Glass Length	Glass Width	Pct Glass or No. of Windows	Glass U-Value	Shading Coefficient	External Shading Type	Internal Shading Type	Percent Solar to Ret. Air	Visible Transmittance	Inside Visible Reflectance
534	1										
M610	1			10	1.04	0.9	3	3			
612	1										
614	1										
620	1										
622	1										
630	1										
632	1										
634	1										
710	1										
712	1										
714	1										
720	1										
722	1										
724	1										
M900	1			20	1.04	1.		3			
902	1										
904	1										
906	1										

Card 26---------- Schedules ----------

Room Number	People	Lights	Ventilation	Infiltration	Reheat Minimum	Cooling Fans	Heating Fan	Auxiliary Fan	Room Exhaust	Daylighting Controls
M100	A-P8HPD	A-L8HPD	AVAIL	OFF		AVAIL	AVAIL	AVAIL	AVAIL	
160	AVAIL	AVAIL								
170	AVAIL	AVAIL								
180	AVAIL	AVAIL								
190	NONE	NONE	NONE	NONE		NONE	NONE			
M210	AVAIL	AVAIL	AVAIL	AVAIL		AVAIL	AVAIL	AVAIL	AVAIL	
240	NONE	NONE	NONE	NONE		NONE	NONE			
M300	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
302						A-MODSKF			A-MODSKF	
330	A-P8HPD	A-L8HPD			A-ORSCH					
332	A-P8HPD	A-L8HPD			A-ORSCH					
334	A-P8HPD	A-L8HPD			A-ORSCH					
350	NONE	NONE	NONE	NONE		NONE	NONE			
M510	AVAIL	AVAIL	AVAIL	OFF		AVAIL	AVAIL		AVAIL	
M610	A-P8HPD	A-L8HPD	AVAIL	AVAIL		AVAIL	AVAIL		AVAIL	
800	NONE	NONE	NONE	NONE		NONE	NONE			
810	NONE	NONE	NONE	NONE		NONE	NONE			

SCHEDULES FANS MINIMUMS OR only

Card 65---------- Heating Load Assignment ----------

Load Assignment Reference	All Coil Loads To Heating Ref	-Group 1- Begin	End	-Group 2- Begin	End	-Group 3- Begin	End	-Group 4- Begin	End	-Group 5- Begin	End	-Group 6- Begin	End	-Group 7- Begin	End	-Group 8- Begin	End	-Group 9- Begin	End
1	1	1	11																

Card 67---------- Heating Equipment Parameters ----------

Heat Ref Number	Equip Code Name	Number Of Units	HW Pmp Full Ld Value	Units	Cap'y Value	Units	Energy Rate Value	Units	Seq Order Number	Switch over Control	Hot Strg	Misc. Acc.	Cogen	Demand Limit Number
1	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF						
2	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF						
3	EQ2002	1	40	HP	15000	MBH	80.0	PCTEFF						

Card 69---------- Fan Equipment Parameters ----------

System Set Number	Cooling Fan	Heating Fan	Return Fan	Exhaust Fan	Auxiliary Supply	Room Exhaust	Optional Ventilation
1	EQ4001		EQ4004			SAMPLE-F	
2	EQ4001		EQ4004			SAMPLE-F	
3	EQ4001					SAMPLE-F	
4	EQ4001		EQ4004			SAMPLE-F	
5	EQ4001					SAMPLE-F	
6	EQ4280					SAMPLE-F	
7	EQ4001		EQ4004			SAMPLE-F	
8	EQ4001					SAMPLE-F	
9	EQ4001					SAMPLE-F	
10	EQ4001					SAMPLE-F	
11	EQ4000					EQ4000	

VSD on OR fan

Card 70---------- Fan Equipment KW Overrides ----------

System Set Number	-----MAIN SYSTEM----- Cool Fan KW	Heat Fan KW	Ret Fan KW	Exh Fan KW	Aux Sup KW	Room Exh KW	Opt Vent KW	--OTHER SYSTEM-- Cool Fan	Heat Fan	Aux Fan	Room Exh Fan	----DEMAND LIMIT PRIORITY--- Opt Vent Fan
1	80		25									
2	80		25									
3	80											
4	100		13									
5	17											
6	33											
7	100		13									
8												
9												
10	16					60						
11												

Utility Description Reference Table

Schedules:
- A-L8HPD LIGHTS 8HR/DA
- A-MODSKF KIT FAN MOD SCH
- A-ORSCH OR FAN SCHEDULE
- A-P8HPD PEOPLE 8HR/DA
- AVAIL AVAILABLE (100%)
- BLGBASE2 HOSPITAL BLG TEMPLATE HOT WATER SCHEDULE
- CL_76 COOLING TSTAT - CONST 76F
- HOTRLGT HOTEL ROOMS LIGHTS
- HT_75 HEATING TSTAT - CONST 75F
- NONE ANY PROJECT
- OFF ALWAYS OFF

System:
- FC FAN COIL
- FPVAV FAN POWERED VAV
- PTAC PACKAGED TERMINAL AIR COND.
- UV UNIT VENTILATOR
- VRH VARIABLE VOLUME REHEAT

Equipment:

Cooling:
- EQ1001L 2-STG CENTRIFUGAL CHILLER >550 TONS
- EQ1120L AIR-CLD RECIPROCATING > 22 TONS
- EQ1307 PACKAGED TERMINAL AIR CONDITIONER
- THRMCHHE TRANE DIRECT FIRED ABSORBER, 1.07 COP

Heating:
- EQ2002 GAS FIRED STEAM BOILER

Fan:
- EQ4000 PREVENTS CONSUMPTION OF FAN ENERGY
- EQ4001 AIR FOIL CENTRIFUGAL - CONSTANT VOLUME
- EQ4004 AXIAL FLOW - CONSTANT VOLUME (MODEL Q)
- EQ4280 AIR FOIL FAN W\VARIABLE SPEED DRIVE
- SAMPLE-F SAMPLE GENERIC FAN

Tower:
- EQ5100 COOLING TOWER FANS

Misc:
- EQ5003 CHILLED WATER PUMP-VAV(SAME AS EQ5007)

Schedule Name: A-ORSCH for min. position
Project: OR FAN SCHEDULE
Location: EISENHOWER AMC
Client:
Program User:
Comments:

Starting Month: JAN Ending Month: DEC
Starting Day Type: DSGN Ending Day Type: WKDY

Hour	Util Percent
0	40
6	100
17	40
24	

Starting Month: JAN Ending Month: DEC
Starting Day Type: SAT Ending Day Type: SUN

Hour	Util Percent
0	40
24	

RS&H

SUBJECT _____ AEP NO _____
SHEET _____ OF _____
DESIGNER Hutchins DATE 3/11/96
CHECKER _____ DATE _____

ECO # LT 2 Reduce Lighting Levels

Delamp Hallway Light Fixtures (2x4 2L)

Area	#
1A -	11
1B -	29
1C -	25
1D -	32
1E -	15
1F -	14
1G -	14
1H -	22
1J -	21
1K -	20
1L -	27
	230

Area	#
2A -	0
2B -	17
2C -	4
2D -	32
2E -	19
2F -	23
2G -	28
2H -	12
2I -	13
2J -	14
2K -	11
2L -	23
2M -	12
2N -	11
2O -	29
2P -	21
2Q -	18
2R -	22
	281

Area	#
3A -	0
3B -	0
3C -	7
3D -	20
3E -	8
3F -	19
3G -	3
3H -	19
3I -	0
3J -	0
3K -	29
3L -	7
3M -	0
3N -	0
3O -	2
3P -	15
	129

4A -	15	5A	16	6A		7-13A	25
4B -	4	5B -	35	6B		7-13B	42
4C -	15	5C -	16	6C		7-13C	24
	34		67				91

TOTAL = 230 + 281 + 129 + 34 + 67 + 91 * 8 = 1469 fixtures

Energy saving assuming all are T8's (2L → 1L) (58w → 32w)

$$\frac{1469 * 26w * 8760}{1000} = 334,579 \text{ kwh} = 1142 \text{ MBTU/yr.}$$

RS&H

SUBJECT _____ AEP NO _____

_____ SHEET _____ OF _____

DESIGNER _____ DATE _____

CHECKER _____ DATE _____

Delamping Library (4th FLR)

42 4L Fluorescents

Current light level readings range from 100 to 190

Removing 2 lamps and disconnecting one ballast saves half the fixture energy

Assume they will be converted to T8's (58w - 32w)

$$\text{Savings} = \frac{26\ \text{watt}}{\text{fixture}} * 42 * \frac{5\ \text{da}}{\text{wk}} * \frac{52\ \text{wk}}{\text{yr}} * \frac{10\ \text{hr}}{\text{da}} \Big/ 1000$$

$$= 2839\ \frac{\text{kwh}}{\text{yr}} = 10\ \frac{\text{MBtu}}{\text{yr}}$$

Switching half of Family Practice Medical Records area lights off saves

$$\text{Savings} = \frac{26\ \text{w}}{\text{fixt}} * 24 * 5 * 52 * 10 / 1000 = 1622\ \frac{\text{kwh}}{\text{yr}}$$

$$= 6\ \text{MBtu/yr}$$

Total delamping savings = 1142 + 10 + 6 = 1158 MBtu/yr.

Total fixtures = 1469 + 42 + 24 = 1535

LT 2 - 2

FTGORDON Lumen Method

Reynolds, Smith & Hills, Inc.
4651 Salisbury Road
Jacksonville, FL 32256

EXISTING CONDITIONS
HALLWAY

Lumen Method Computation
Generated by LitePro V2.27E
Provided and supported by USI Lighting, Inc.
Filename: FTGORDON Type: Indoor

Lumen Method Computation	
Project name: EAMC Energy Audit	Project #
Prepared for: Savannah District COE	Date: 11-Mar-96
Prepared by: Paul Hutchins	

Area Name : HALLWAY No. Identical Areas = 1
Description: TYPICAL HALLWAY

DIMENSIONS:	(Ft)	REFLECTANCES:	(Dec. %)
Width (E-W) :	8.00	Ceiling :	0.80
Length (N-S) :	56.00	North Wall :	0.50
Ceiling Height :	9.00	East Wall :	0.50
Mounting Height :	9.00	South Wall :	0.50
Workplane Height :	2.50	West Wall :	0.50
Total Area :	448.00	Floor Cavity:	0.50
RCR (Room Ratio) :	4.64		

ENVIRONMENTAL CONDITION: Very Clean # OBSTRUCTIONS: 0

Type F2 : TEST #K10193, COLUMBIA, 2J240-HP, PATTERN-LITE
2'X4' 2L STATIC GRID TROFFER, HOLOPHANE #8224 LESS OVERLAY
LAMPS: (2) F40CW, Lumens= 3050
BALLAST: ESB, WATTS= 90
COEFFICIENT OF UTILIZATION: 55.6%

FACTORS:	.....	PLACEMENT:	.....
Luminaire Dirt :	0.87	Total Number :	7
Lamp Lumen Loss :	0.88	Pattern :	0.0X 8.0
Ballast :	0.95	# Columns/Rows :	1/7
Lamp/ballast :	1.00	Start Column (X) :	4.00
Misc :	1.00	Start Row (Y) :	4.00
>> Total LLF :	0.73		
PERFORMANCE:	.....		
Ave. Footcandles :	38.51		
Watts/Sq. Foot :	1.41		

******

Uses IES procedures for Lumen Method. USI is not responsible for light output of lamp/ballast, non-USI products, or design variables not shown.

FTGORDON Lumen Method

Reynolds, Smith & Hills, Inc.
4651 Salisbury Road
Jacksonville, FL 32256

PROPOSED DELAMP TO ONE LAMP PER FIXTURE

Lumen Method Computation
Generated by LitePro V2.27E
Provided and supported by USI Lighting, Inc.
Filename: FTGORDON Type: Indoor

Lumen Method Computation	
Project name: EAMC Energy Audit	Project #
Prepared for: Savannah District COE	Date: 11-Mar-96
Prepared by: Paul Hutchins	

Area Name : HALLWAY No. Identical Areas = 1
Description: TYPICAL HALLWAY

DIMENSIONS:	(Ft)	REFLECTANCES:	(Dec. %)
Width (E-W) :	8.00	Ceiling :	0.80
Length (N-S) :	56.00	North Wall :	0.50
Ceiling Height :	9.00	East Wall :	0.50
Mounting Height :	9.00	South Wall :	0.50
Workplane Height :	2.50	West Wall :	0.50
Total Area :	448.00	Floor Cavity:	0.50
RCR (Room Ratio) :	4.64		

ENVIRONMENTAL CONDITION: Very Clean # OBSTRUCTIONS: 0

Type F3 : TEST #10083, COLUMBIA, 5PA4*-52-141, 5PA
1X4 1L FLUSH AIRHANDLE TROFFER, LENS- .110" THK PRISMATIC A12
LAMPS: (1) F40WW, Lumens= 3050
BALLAST: ESB, WATTS= 45
COEFFICIENT OF UTILIZATION: 47.3%

FACTORS:	.....	PLACEMENT:	.....
Luminaire Dirt :	0.87	Total Number :	7
Lamp Lumen Loss :	0.88	Pattern :	0.0X 8.0
Ballast :	0.95	# Columns/Rows :	1/7
Lamp/ballast :	1.00	Start Column (X) :	4.00
Misc :	1.00	Start Row (Y) :	4.00
>> Total LLF :	0.73		
PERFORMANCE:	.....		
Ave. Footcandles :	16.38		
Watts/Sq. Foot :	0.70		

******

Uses IES procedures for Lumen Method. USI is not responsible for light output of lamp/ballast, non-USI products, or design variables not shown.

CONSTRUCTION COST ESTIMATE

Project:	ECO # LT2-1 Reduce Lighting Levels (Delamp Fixtures)	RS&H No.:	694-1331-005
Location:	Fort Gordon, GA	Date:	3/12/96
Basis:	Schematic Design	Estimator:	P. HUTCHINS
Building:	Eisenhower Army Medical Center	Filename:	EST_LT2.XLS

	QUANTITY		MATERIAL/EQUIP		LABOR		TOTAL	SOURCE	
ITEM DESCRIPTION	No.	Unit	$/Unit	Total	$/Unit	Total	COST	Material	Labor
Delamp Fixture	1535	ea			$3.91	$6,002	$6,002		MEp15
Subtotal Bare Costs				$0		$6,002	$6,002		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$0		$6,002	$6,002		
City Cost Index (Aug. GA)			0%	$0	-46%	($2,761)	($2,761)	MMp533	MMp533
				-		-	-		
Subtotal				$0		$3,241	$3,241		
OH & Profit Markups			10%	$0	53%	$1,718	$1,718	MMp7	MMp475
				-		-	-		
Subtotal				$0		$4,959	$4,959		
Sales Taxes			6.0%	$0		NA	$0	MMp476	
				-		-	-		
Subtotal				$0		$4,959	$4,959		
Contingency			10%	$0	10%	$496	$496	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$0		$5,455	$5,455		
Design Fee				NA	6.0%	$298	$298		
SIOH				NA	6.0%	$298	$298		
				-		-	-		
Total Project Cost				$0		$6,051	$6,051		

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###.
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###
Dp###	2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: LT2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-LT2 REDUCE LIGHTING LEVELS
FISCAL YEAR 1996 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 03-12-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 5500.		
B. SIOH	$ 330.		
C. DESIGN COST	$ 330.		
D. TOTAL COST (1A+1B+1C)	$ 6160.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 6160.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	1158.	$ 8824.	13.68	$ 120712.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		1158.	$ 8824.		$ 120712.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 8824.

5. SIMPLE PAYBACK PERIOD (1G/4) .70 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 120712.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 19.60
(IF < 1 PROJECT DOES NOT QUALIFY)

RS&H

SUBJECT _____ AEP NO _____

SHEET _____ OF _____

DESIGNER Hutchins DATE 2/14/96

CHECKER _____ DATE _____

LT4C1 Compact Fluorescents in Restrooms

Replace existing 52-w incandescent with 15 watt fluorescent

Bulb	watt	lumens	Life	Price	
A19 (inc.)	52	800	1000	$0.69	(1)
SLS 15 (fl.)	15	900	10,000	22.21	(2) (3-tube)

Restroom operating hours:

4 hrs/da, 7 da/wk = 1456 hrs/yr.

Savings = $\frac{(52-15) * 1456 * 1258}{1000}$ = 67,771 kwh/yr

1258 lamps

231 MBtu/yr

Replacement cost savings

$$\frac{1258 * 1456 \text{ hr/yr}}{1000 \text{ hr/yr}} * \frac{\$7.57}{\text{lamp}}{}^{(3)} - \frac{1258 * 1456}{10{,}000} * 29.09 = \$8537./\text{yr}$$

(1) Granger 1995 #386 p. 845

(2) p. 863

(3) Labor cost = $\frac{15 \text{ min/lamp}}{60 \text{ min/hr}} * \frac{\$27.50}{\text{hr}} = \frac{\$6.88}{\text{lamp}}$

SPOT RELAMP

FT. GORDON EISENHOWER ARMY MEDICAL CENTER

SURVEY OF INCANDESCENT LAMPS FOR
REPLACEMENT WITH FLUORESCENT LAMPS

ROOM #	ROOM DESCRIPTION	# LAMPS
1D-02	REST ROOM	1
1D-03	REST ROOM	1
1D-44	REST ROOM	1
1G-02	REST ROOM	2
1G-03	REST ROOM	2
1J-23	REST ROOM	1
2B-32	REST ROOM	1
2C-18	REST ROOM	1
2C-19	JANITOR ROOM	1
2C-20	REST ROOM	1
2C-21	REST ROOM	1
2D-05	REST ROOM	1
2D-06	REST ROOM	1
2F-37	REST ROOM	1
2G-11	REST ROOM	1
2I-05	REST ROOM	1
2I-15	REST ROOM	1
2I-16	REST ROOM	1
2J-03	REST ROOM	1
2J-04	REST ROOM	1
2K-09	R/R & SHOWER	2
2K-11	R/R & SHOWER	2
2L-07	REST ROOM	1
2M-02	REST ROOM	1
2Q-06	REST ROOM	1
2Q-07	REST ROOM	1
2Q-38	REST ROOM	1
2R-22	REST ROOM	1
3F-12	REST ROOM	1
3F-13	REST ROOM	1
3G-04	JANITOR ROOM	1
3G-05	REST ROOM	1
3I-10	SHOWER ROOM	1
3K-06	REST ROOM	1
3K-28	REST ROOM	1
3K-30	REST ROOM	3
3K-38	REST ROOM	1
3L-07	JANITOR ROOM	1
4C-18	CONFERENCE ROOM	40
5A-03	REST ROOM	1
5A-04	REST ROOM	1
5A-16	REST ROOM	1
5A-17	REST ROOM	1
5A-20	SHOWER ROOM	2
5A-21	SHOWER ROOM	2
5A-22	SHOWER ROOM	2
5A-24	REST ROOM	1
5A-25	REST ROOM	1
5A-26	REST ROOM	1
5A-30	JANITOR ROOM	1
5A-33	REST ROOM	1
5A-34	REST ROOM	1
5B-02	REST ROOM	1
5B-07	REST ROOM	1
5B-10	REST ROOM	1
5B-11	PATIENT BED ROOM	2
5B-12	REST ROOM	1
5B-13	REST ROOM	1
5B-14	PATIENT BED ROOM	2
5B-15	PATIENT BED ROOM	2
5B-16	REST ROOM	1
5B-17	COMPUTER ROOM	2
5B-18	REST ROOM	1
5B-30	SHOWER ROOM	2
5B-33	SHOWER ROOM	2
5B-34	SHOWER ROOM	2
5B-37	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
5B-44	JANITOR ROOM	1
5B-45	PATIENT BED ROOM	2
5B-46	REST ROOM	1
5B-47	REST ROOM	1
5B-48	PATIENT BED ROOM	2
5B-49	PATIENT BED ROOM	2
5B-50	PATIENT BED ROOM	2
5B-51	PATIENT BED ROOM	2
5B-51	REST ROOM	1
5B-52	REST ROOM	1
5B-53	PATIENT BED ROOM	2
5B-54	REST ROOM	1
5B-55	REST ROOM	1
5B-57	REST ROOM	1
5C-01	PATIENT BED ROOM	2
5C-02	REST ROOM	1
5C-03	PATIENT BED ROOM	2
5C-04	REST ROOM	1
5C-05	PATIENT BED ROOM	2
5C-06	REST ROOM	1
5C-07	PATIENT BED ROOM	2
5C-12	REST ROOM	1
5C-13	PATIENT BED ROOM	2
5C-15	PATIENT BED ROOM	2
5C-16	REST ROOM	1
5C-18	REST ROOM	1
5C-20	REST ROOM	1
5C-22	REST ROOM	1
5C-23	PATIENT BED ROOM	2
5C-24	REST ROOM	1
5C-25	PATIENT BED ROOM	2
5C-26	REST ROOM	1
5C-27	PATIENT BED ROOM	2
5C-28	REST ROOM	1
6A-01	PATIENT BED ROOM	2
6A-02	REST ROOM	1
6A-03	PATIENT BED ROOM	2
6A-04	R/R AND SHOWER	2
6A-05	SHOWER ROOM	2
6A-06	PATIENT BED ROOM	2
6A-07	REST ROOM	1
6A-08	REST ROOM	1
6A-09	PATIENT BED ROOM	2
6A-10	PATIENT BED ROOM	2
6A-11	REST ROOM	1
6A-12	PATIENT BED ROOM	2
6A-13	R/R AND SHOWER	2
6A-15	PATIENT BED ROOM	2
6A-16	R/R AND SHOWER	2
6A-19	R/R AND SHOWER	2
6A-20	PATIENT BED ROOM	2
6A-22	REST ROOM	1
6A-23	REST ROOM	1
6A-24	PATIENT BED ROOM	2
6A-25	REST ROOM	1
6A-26	PATIENT BED ROOM	2
6A-34	SHOWER ROOM	2
6A-41	JANITOR ROOM	1
6A-48	KITCHEN	1
6B-01	PATIENT BED ROOM	2
6B-02	R/R AND SHOWER	2
6B-03	REST ROOM	1
6B-14	PATIENT BED ROOM	2
6B-15	REST ROOM	1
6B-16	MICROSCOPE ROOM	2
6B-17	REST ROOM	1
6B-18	PATIENT BED ROOM	2
6B-19	REST ROOM	1
6B-31	REST ROOM	2
6B-31	SHOWER	1
6B-36	R/R AND SHOWER	2

ROOM #	ROOM DESCRIPTION	# LAMPS
6B-36	SHOWER	1
6B-50	REST ROOM	1
6B-51	REST ROOM	1
6B-54	REST ROOM	1
6B-55	REST ROOM	1
6B-61	R/R AND SHOWER	2
6B-62	CLEAN LINEN ROOM	1
6B-63	PATIENT BED ROOM	2
6B-64	REST ROOM	1
6C-01	PATIENT BED ROOM	2
6C-02	REST ROOM	1
6C-03	PATIENT BED ROOM	2
6C-04	REST ROOM	1
6C-05	PATIENT BED ROOM	2
6C-06	REST ROOM	1
6C-07	PATIENT BED ROOM	2
6C-08	REST ROOM	1
6C-09	PATIENT BED ROOM	2
6C-10	R/R AND SHOWER	2
6C-11	SHOWER ROOM	2
6C-12	PATIENT BED ROOM	2
6C-13	R/R AND SHOWER	2
6C-14	CONFERENCE ROOM	2
6C-15	REST ROOM	1
6C-16	PATIENT BED ROOM	2
6C-17	REST ROOM	1
6C-20	SUPPLY ROOM	1
6C-30	R/R AND SHOWER	2
6C-31	PATIENT BED ROOM	2
6C-33	R/R AND SHOWER	2
6C-35	SHOWER ROOM	2
6C-36	REST ROOM	2
6C-37	PATIENT BED ROOM	2
6C-40	SHOWER ROOM	2
6C-41	R/R AND SHOWER	2
6C-42	PATIENT BED ROOM	2
6C-44	JANITOR ROOM	1
6C-45	SUPPLY ROOM	1
6C-48	PATIENT BED ROOM	2
6C-49	R/R AND SHOWER	2
6C-50	PATIENT BED ROOM	2
6C-51	REST ROOM	1
6C-52	PATIENT BED ROOM	2
6C-53	REST ROOM	1
7A-01	CONFERENCE ROOM	2
7A-02	PATIENT BED ROOM	2
7A-03	R/R & SHOWER	2
7A-04	PATIENT BED ROOM	2
7A-05	R/R & SHOWER	2
7A-07	PATIENT BED ROOM	2
7A-08	R/R & SHOWER	2
7A-09	SHOWER ROOM	2
7A-11	R/R & SHOWER	2
7A-12	SHOWER ROOM	2
7A-13	PATIENT BED ROOM	2
7A-14	R/R & SHOWER	2
7A-16	PATIENT BED ROOM	2
7A-17	REST ROOM	1
7A-18	PATIENT BED ROOM	2
7A-19	REST ROOM	1
7A-21	PATIENT BED ROOM	2
7A-22	REST ROOM	1
7A-23	REST ROOM	1
7A-24	PATIENT BED ROOM	2
7A-29	SHOWER ROOM	2
7A-30	PATIENT BED ROOM	2
7A-31	R/R & SHOWER	2
7A-32	SHOWER ROOM	2
7A-33	PATIENT BED ROOM	2
7A-34	R/R & SHOWER	2
7A-35	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
7A-36	PATIENT BED ROOM	2
7A-37	R/R & SHOWER	2
7A-39	PATIENT BED ROOM	2
7A-40	R/R & SHOWER	2
7A-41	CLEAN LINEN ROOM	1
7A-50	NURSE'S LOUNGE	2
7B-01	PATIENT BED ROOM	2
7B-02	REST ROOM	1
7B-04	PATIENT BED ROOM	2
7B-05	REST ROOM	1
7B-07	REST ROOM	1
7B-08	REST ROOM	1
7B-09	PATIENT BED ROOM	2
7B-10	REST ROOM	1
7B-12	JANITOR ROOM	1
7B-13	REST ROOM	1
7B-25	REST ROOM	1
7B-26	REST ROOM	1
7B-33	HOUSE KEEPER RM	1
7B-34	R/R & SHOWER	2
7B-35	PATIENT BED ROOM	2
7B-36	PATIENT BED ROOM	2
7B-37	R/R & SHOWER	2
7B-38	PATIENT BED ROOM	2
7B-39	REST ROOM	1
7B-41	REST ROOM	1
7B-48	PATIENT BED ROOM	2
7B-49	REST ROOM	1
7B-50	PATIENT BED ROOM	2
7B-51	REST ROOM	1
7B-52	PATIENT BED ROOM	2
7B-53	REST ROOM	1
7C-01	PATIENT BED ROOM	2
7C-02	REST ROOM	1
7C-03	PATIENT BED ROOM	2
7C-04	R/R & SHOWER	2
7C-06	PATIENT BED ROOM	2
7C-08	SHOWER ROOM	2
7C-09	PATIENT BED ROOM	2
7C-10	R/R & SHOWER	2
7C-11	SHOWER ROOM	2
7C-12	PATIENT BED ROOM	2
7C-13	R/R & SHOWER	2
7C-14	SHOWER ROOM	2
7C-15	PATIENT BED ROOM	2
7C-16	R/R & SHOWER	2
7C-18	PATIENT BED ROOM	2
7C-19	REST ROOM	1
7C-20	REST ROOM	1
7C-21	PATIENT BED ROOM	2
7C-22	REST ROOM	1
7C-23	REST ROOM	1
7C-25	PATIENT BED ROOM	2
7C-26	R/R & SHOWER	2
7C-27	PATIENT BED ROOM	2
7C-28	R/R & SHOWER	2
7C-29	LINEN CLOSET	1
7C-30	PATIENT BED ROOM	2
7C-31	R/R & SHOWER	2
7C-32	SHOWER ROOM	2
7C-33	PATIENT BED ROOM	2
7C-34	R/R & SHOWER	2
7C-35	SHOWER ROOM	2
7C-36	PATIENT BED ROOM	2
7C-37	R/R & SHOWER	2
7C-40	R/R & SHOWER	2
7C-49	NURSE'S LOUNGE	1
7C-50	REST ROOM	1
8A-03	R/R & SHOWER	2
8A-05	R/R & SHOWER	2
8A-08	R/R & SHOWER	2

LT4 - ~~#~~ 2

ROOM #	ROOM DESCRIPTION	# LAMPS
8A-09	SHOWER ROOM	2
8A-11	R/R & SHOWER	2
8A-12	SHOWER ROOM	2
8A-14	R/R & SHOWER	2
8A-17	REST ROOM	1
8A-19	REST ROOM	1
8A-22	REST ROOM	1
8A-23	REST ROOM	1
8A-29	SHOWER ROOM	2
8A-31	R/R & SHOWER	2
8A-32	SHOWER ROOM	2
8A-34	R/R & SHOWER	2
8A-35	SHOWER ROOM	2
8A-37	R/R & SHOWER	2
8A-40	R/R & SHOWER	2
8A-41	LINEN CLOSET	1
8A-50	NURSE'S LOUNGE	2
8B-02	REST ROOM	1
8B-03	JANITOR ROOM	1
8B-05	REST ROOM	1
8B-07	REST ROOM	1
8B-08	REST ROOM	1
8B-10	REST ROOM	1
8B-12	JANITOR ROOM	1
8B-13	REST ROOM	1
8B-25	REST ROOM	1
8B-26	REST ROOM	1
8B-34	R/R & SHOWER	2
8B-37	R/R & SHOWER	2
8B-39	REST ROOM	1
8B-41	REST ROOM	1
8B-47	R/R & SHOWER	2
8B-48	LOCKER ROOM	1
8B-50	R/R & SHOWER	2
8B-51	LOCKER ROOM	1
8B-53	REST ROOM	1
8B-55	REST ROOM	1
8B-56	TELEPHONE AREA	1
8C-02	REST ROOM	1
8C-04	R/R & SHOWER	2
8C-07	R/R & SHOWER	2
8C-08	SHOWER ROOM	2
8C-10	R/R & SHOWER	2
8C-11	SHOWER ROOM	2
8C-13	R/R & SHOWER	2
8C-14	SHOWER ROOM	2
8C-16	R/R & SHOWER	2
8C-19	REST ROOM	1
8C-20	REST ROOM	1
8C-22	REST ROOM	1
8C-23	REST ROOM	1
8C-26	R/R & SHOWER	2
8C-28	R/R & SHOWER	2
8C-29	LINEN CLOSET	1
8C-31	R/R & SHOWER	2
8C-32	SHOWER ROOM	2
8C-34	R/R & SHOWER	2
8C-35	SHOWER ROOM	2
8C-37	R/R & SHOWER	2
8C-40	R/R & SHOWER	2
8C-50	REST ROOM	1
9A-01	CONFERENCE ROOM	2
9A-02	PATIENT BED ROOM	2
9A-03	R/R & SHOWER	2
9A-04	PATIENT BED ROOM	2
9A-05	R/R & SHOWER	2
9A-07	PATIENT BED ROOM	2
9A-08	R/R & SHOWER	2
9A-09	SHOWER ROOM	2
9A-11	R/R & SHOWER	2
9A-12	SHOWER ROOM	2
9A-13	PATIENT BED ROOM	2
9A-14	R/R & SHOWER	2
9A-16	PATIENT BED ROOM	2
9A-17	REST ROOM	1
9A-18	PATIENT BED ROOM	2
9A-19	REST ROOM	1
9A-21	PATIENT BED ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
9A-22	REST ROOM	1
9A-23	REST ROOM	1
9A-24	PATIENT BED ROOM	2
9A-29	SHOWER ROOM	2
9A-30	PATIENT BED ROOM	2
9A-31	R/R & SHOWER	2
9A-32	SHOWER ROOM	2
9A-33	PATIENT BED ROOM	2
9A-34	R/R & SHOWER	2
9A-35	SHOWER ROOM	2
9A-36	PATIENT BED ROOM	2
9A-37	R/R & SHOWER	2
9A-39	PATIENT BED ROOM	2
9A-40	R/R & SHOWER	2
9A-41	CLEAN LINEN ROOM	1
9A-50	/R, NURSE'S LAUNG	2
9B-01	PATIENT BED ROOM	2
9B-02	REST ROOM	1
9B-04	PATIENT BED ROOM	2
9B-05	REST ROOM	1
9B-07	REST ROOM	1
9B-08	REST ROOM	1
9B-09	PATIENT BED ROOM	2
9B-10	REST ROOM	1
9B-12	JANITOR ROOM	1
9B-13	REST ROOM	1
9B-25	REST ROOM	1
9B-26	REST ROOM	1
9B-33	HOUSE KEEPER RM	1
9B-34	R/R & SHOWER	2
9B-35	PATIENT BED ROOM	2
9B-36	PATIENT BED ROOM	2
9B-37	R/R & SHOWER	2
9B-38	PATIENT BED ROOM	2
9B-39	REST ROOM	1
9B-41	REST ROOM	1
9B-48	PATIENT BED ROOM	2
9B-49	REST ROOM	1
9B-50	PATIENT BED ROOM	2
9B-51	REST ROOM	1
9B-52	PATIENT BED ROOM	2
9B-53	REST ROOM	1
9C-01	PATIENT BED ROOM	2
9C-02	REST ROOM	1
9C-03	PATIENT BED ROOM	2
9C-04	R/R & SHOWER	2
9C-06	PATIENT BED ROOM	2
9C-08	SHOWER ROOM	2
9C-09	PATIENT BED ROOM	2
9C-10	R/R & SHOWER	2
9C-11	SHOWER ROOM	2
9C-12	PATIENT BED ROOM	2
9C-13	R/R & SHOWER	2
9C-14	SHOWER ROOM	2
9C-15	PATIENT BED ROOM	2
9C-16	R/R & SHOWER	2
9C-18	PATIENT BED ROOM	2
9C-19	REST ROOM	1
9C-20	REST ROOM	1
9C-21	PATIENT BED ROOM	2
9C-22	REST ROOM	1
9C-23	REST ROOM	1
9C-25	PATIENT BED ROOM	2
9C-27	PATIENT BED ROOM	2
9C-30	PATIENT BED ROOM	2
9C-32	SHOWER ROOM	2
9C-33	PATIENT BED ROOM	2
9C-35	SHOWER ROOM	2
9C-36	PATIENT BED ROOM	2
9C-37	R/R & SHOWER	2
9C-40	R/R & SHOWER	2
9C-50	REST ROOM	1
10A-01	CONFERENCE ROOM	2
10A-03	R/R & SHOWER	2
10A-05	R/R & SHOWER	2
10A-08	R/R & SHOWER	2
10A-09	SHOWER ROOM	2
10A-11	R/R & SHOWER	2

ROOM #	ROOM DESCRIPTION	# LAMPS
10A-12	SHOWER ROOM	2
10A-14	R/R & SHOWER	2
10A-17	REST ROOM	1
10A-19	REST ROOM	1
10A-22	REST ROOM	1
10A-23	REST ROOM	1
10A-29	SHOWER ROOM	2
10A-31	R/R & SHOWER	2
10A-32	SHOWER ROOM	2
10A-34	R/R & SHOWER	2
10A-35	SHOWER ROOM	2
10A-37	R/R & SHOWER	2
10A-40	R/R & SHOWER	2
10A-41	CLEAN LINEN ROOM	1
10A-50	NURSE'S LOUNGE	2
10B-02	REST ROOM	1
10B-03	JANITOR ROOM	1
10B-05	REST ROOM	1
10B-07	REST ROOM	1
10B-08	REST ROOM	1
10B-10	REST ROOM	1
10B-12	JANITOR ROOM	1
10B-13	REST ROOM	1
10B-25	REST ROOM	1
10B-26	REST ROOM	1
10B-34	R/R & SHOWER	2
10B-37	R/R & SHOWER	2
10B-39	REST ROOM	1
10B-41	REST ROOM	1
10B-47	R/R & SHOWER	2
10B-48	LOCKER ROOM	1
10B-50	R/R & SHOWER	2
10B-51	LOCKER ROOM	1
10B-53	REST ROOM	1
10B-55	REST ROOM	1
10B-56	TELEPHONE AREA	1
10C-02	REST ROOM	1
10C-04	R/R & SHOWER	2
10C-08	SHOWER ROOM	2
10C-10	R/R & SHOWER	2
10C-11	SHOWER ROOM	2
10C-13	R/R & SHOWER	2
10C-14	SHOWER ROOM	2
10C-16	R/R & SHOWER	2
10C-19	REST ROOM	1
10C-20	REST ROOM	1
10C-22	REST ROOM	1
10C-23	REST ROOM	1
10C-32	SHOWER ROOM	2
10C-35	SHOWER ROOM	2
10C-37	R/R & SHOWER	2
10C-40	R/R & SHOWER	2
10C-50	REST ROOM	1
11A-01	PATIENT BED ROOM	2
11A-02	PATIENT BED ROOM	2
11A-03	R/R & SHOWER	2
11A-04	PATIENT BED ROOM	2
11A-05	R/R & SHOWER	2
11A-06	LINEN ROOM	1
11A-07	PATIENT BED ROOM	2
11A-08	R/R & SHOWER	2
11A-09	SHOWER ROOM	2
11A-11	R/R & SHOWER	2
11A-12	SHOWER ROOM	2
11A-13	PATIENT BED ROOM	2
11A-14	R/R & SHOWER	2
11A-16	PATIENT BED ROOM	2
11A-17	REST ROOM	1
11A-18	PATIENT BED ROOM	2
11A-19	REST ROOM	1
11A-21	PATIENT BED ROOM	2
11A-22	REST ROOM	1
11A-23	REST ROOM	1
11A-24	PATIENT BED ROOM	2
11A-29	SHOWER ROOM	2
11A-30	PATIENT BED ROOM	2
11A-31	R/R & SHOWER	2
11A-32	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
11A-33	PATIENT BED ROOM	2
11A-34	R/R & SHOWER	2
11A-35	SHOWER ROOM	2
11A-36	PATIENT BED ROOM	2
11A-37	R/R & SHOWER	2
11A-39	PATIENT BED ROOM	2
11A-40	R/R & SHOWER	2
11A-41	CLEAN LINEN ROOM	1
11A-50	NURSE'S LOUNGE	2
11B-01	PATIENT BED ROOM	2
11B-02	REST ROOM	1
11B-03	JANITOR ROOM	1
11B-04	PATIENT BED ROOM	2
11B-05	REST ROOM	1
11B-07	REST ROOM	1
11B-08	REST ROOM	1
11B-09	PATIENT BED ROOM	2
11B-10	REST ROOM	1
11B-12	JANITOR ROOM	1
11B-13	REST ROOM	1
11B-25	REST ROOM	1
11B-26	REST ROOM	1
11B-33	HOUSE KEEPER RM	1
11B-34	R/R & SHOWER	2
11B-35	PATIENT BED ROOM	2
11B-36	PATIENT BED ROOM	2
11B-37	R/R & SHOWER	2
11B-38	PATIENT BED ROOM	2
11B-39	REST ROOM	1
11B-40	BREAK ROOM	2
11B-41	REST ROOM	1
11B-48	PATIENT BED ROOM	2
11B-49	REST ROOM	1
11B-50	PATIENT BED ROOM	2
11B-51	REST ROOM	1
11B-52	PATIENT BED ROOM	2
11B-53	REST ROOM	1
11C-01	OFFICE ROOM	2
11C-02	REST ROOM	1
11C-03	PATIENT BED ROOM	2
11C-04	R/R & SHOWER	2
11C-06	PATIENT BED ROOM	2
11C-08	SHOWER ROOM	2
11C-09	PATIENT BED ROOM	2
11C-10	R/R & SHOWER	2
11C-11	SHOWER ROOM	2
11C-12	PATIENT BED ROOM	2
11C-13	R/R & SHOWER	2
11C-14	SHOWER ROOM	2
11C-15	PATIENT BED ROOM	2
11C-16	R/R & SHOWER	2
11C-18	PATIENT BED ROOM	2
11C-19	REST ROOM	1
11C-20	REST ROOM	1
11C-21	CONFERENCE ROOM	2
11C-22	REST ROOM	1
11C-23	REST ROOM	1
11C-25	PATIENT BED ROOM	2
11C-27	PATIENT BED ROOM	2
11C-29	LINEN CLOSET	1
11C-30	PATIENT BED ROOM	2
11C-32	SHOWER ROOM	2
11C-33	PATIENT BED ROOM	2
11C-35	SHOWER ROOM	2
11C-36	PATIENT BED ROOM	2
11C-37	R/R & SHOWER	2
11C-40	R/R & SHOWER	2
11C-41	STORAGE ROOM	1
11C-50	REST ROOM	1
12A-01	PATIENT BED ROOM	2
12A-02	PATIENT BED ROOM	2
12A-03	R/R & SHOWER	2
12A-04	PATIENT BED ROOM	2
12A-05	R/R & SHOWER	2
12A-06	STORAGE ROOM	1
12A-07	PATIENT BED ROOM	2
12A-08	R/R & SHOWER	2
12A-09	SHOWER ROOM	2

ROOM #	ROOM DESCRIPTION	# LAMPS
12A-10	PATIENT BED ROOM	2
12A-11	R/R & SHOWER	2
12A-12	SHOWER ROOM	2
12A-13	PATIENT BED ROOM	2
12A-14	REST ROOM	1
12A-15	PATIENT BED ROOM	2
12A-16	REST ROOM	1
12A-17	PATIENT BED ROOM	2
12A-18	REST ROOM	1
12A-19	REST ROOM	1
12A-20	PATIENT BED ROOM	2
12A-21	REST ROOM	1
12A-22	REST ROOM	1
12A-23	PATIENT BED ROOM	2
12A-24	PATIENT BED ROOM	2
12A-25	R/R & SHOWER	2
12A-26	PATIENT BED ROOM	2
12A-27	R/R & SHOWER	2
12A-28	SHOWER ROOM	2
12A-29	PATIENT BED ROOM	2
12A-30	REST ROOM	1
12A-31	PATIENT BED ROOM	2
12A-32	REST ROOM	1
12A-33	PATIENT BED ROOM	2
12A-34	R/R & SHOWER	2
12A-35	STORAGE ROOM	1
12A-36	PATIENT BED ROOM	2
12A-37	REST ROOM	1
12A-45	REST ROOM	1
12A-46	NURSE'S LOUNGE	1
12A-51	REST ROOM	1
12A-51	SHOWER ROOM	2
12A-52	SHOWER ROOM	2
12B-01	PATIENT BED ROOM	2
12B-02	REST ROOM	1
12B-03	JANITOR ROOM	1
12B-05	REST ROOM	1
12B-06	REST ROOM	1
12B-07	OFFICE ROOM	2
12B-08	REST ROOM	1
12B-09	PATIENT BED ROOM	2
12B-10	REST ROOM	1
12B-11	PATIENT BED ROOM	2
12B-12	JANITOR ROOM	1
12B-13	REST ROOM	1
12B-22	STORAGE ROOM	1
12B-26	REST ROOM	1
12B-27	REST ROOM	1
12B-45	REST ROOM	1
12B-46	REST ROOM	1
12B-47	REST ROOM	1
12B-48	PATIENT BED ROOM	2
12B-49	PATIENT BED ROOM	2
12B-50	REST ROOM	1
12B-51	LINEN CLOSET	1
12B-52	OFFICE ROOM	2
12B-53	REST ROOM	1
12C-05	REST ROOM	1
12C-06	REST ROOM	1
12C-13	REST ROOM	1
12C-14	SHOWER ROOM	2
12C-15	PATIENT BED ROOM	2
12C-16	REST ROOM	1
12C-17	REST ROOM	1
12C-18	PATIENT BED ROOM	2
12C-19	REST ROOM	1
12C-25	REST ROOM	1
12C-26	REST ROOM	1
12C-32	SHOWER ROOM	2
12C-33	SHOWER ROOM	2
12C-34	SHOWER ROOM	2
12C-35	SHOWER ROOM	2
12C-41	REST ROOM	1
12C-42	NURSE'S LOUNGE	1
13A-01	PATIENT BED ROOM	2
13A-02	PATIENT BED ROOM	2
13A-03	R/R & SHOWER	2
13A-04	SUPPLY ROOM	1

ROOM #	ROOM DESCRIPTION	# LAMPS
13A-05	R/R & SHOWER	2
13A-06	PATIENT BED ROOM	2
13A-07	PATIENT BED ROOM	2
13A-08	R/R & SHOWER	2
13A-09	SHOWER ROOM	2
13A-10	PATIENT BED ROOM	2
13A-11	R/R & SHOWER	2
13A-12	SHOWER ROOM	2
13A-13	PATIENT BED ROOM	2
13A-14	REST ROOM	1
13A-15	PATIENT BED ROOM	2
13A-16	REST ROOM	1
13A-17	REST ROOM	1
13A-18	PATIENT BED ROOM	2
13A-19	REST ROOM	1
13A-20	REST ROOM	1
13A-21	PATIENT BED ROOM	2
13A-22	REST ROOM	1
13A-23	PATIENT BED ROOM	2
13A-24	PATIENT BED ROOM	2
13A-25	R/R & SHOWER	2
13A-26	SHOWER ROOM	2
13A-27	R/R & SHOWER	2
13A-28	PATIENT BED ROOM	2
13A-29	REST ROOM	1
13A-30	PATIENT BED ROOM	2
13A-31	PATIENT BED ROOM	2
13A-32	REST ROOM	1
13A-33	PATIENT BED ROOM	2
13A-34	R/R & SHOWER	2
13A-35	STORAGE ROOM	1
13A-36	PATIENT BED ROOM	2
13A-37	R/R & SHOWER	2
13A-38	LINEN CLOSET	1
13A-45	NURSE'S LOCKER	1
13A-46	REST ROOM	1
13A-52	SHOWER ROOM	2
13A-53	SHOWER ROOM	2
13B-01	PATIENT BED ROOM	2
13B-02	REST ROOM	1
13B-03	JANITOR ROOM	1
13B-05	REST ROOM	1
13B-06	REST ROOM	1
13B-07	PATIENT BED ROOM	2
13B-08	REST ROOM	1
13B-09	JANITOR ROOM	1
13B-10	PATIENT BED ROOM	2
13B-11	REST ROOM	1
13B-29	REST ROOM	1
13B-30	PATIENT BED ROOM	2
13B-32	REST ROOM	1
13B-33	PATIENT BED ROOM	2
13B-34	PATIENT BED ROOM	2
13B-35	REST ROOM	1
13B-42	PATIENT BED ROOM	2
13B-43	REST ROOM	1
13B-44	LINEN CLOSET	1
13B-45	PATIENT BED ROOM	2
13B-46	REST ROOM	1
13C-01	PATIENT BED ROOM	2
13C-02	REST ROOM	1
13C-03	REST ROOM	1
13C-04	PATIENT BED ROOM	2
13C-05	PATIENT BED ROOM	2
13C-06	R/R & SHOWER	2
13C-07	SHOWER ROOM	2
13C-08	SHOWER ROOM	2
13C-09	R/R & SHOWER	2
13C-10	PATIENT BED ROOM	2
13C-11	PATIENT BED ROOM	2
13C-12	R/R & SHOWER	2
13C-13	SHOWER ROOM	2
13C-14	PATIENT BED ROOM	2
13C-15	R/R & SHOWER	2
13C-16	PATIENT BED ROOM	2
13C-17	REST ROOM	1
13C-18	PATIENT BED ROOM	2
13C-19	REST ROOM	1
13C-20	REST ROOM	1

ROOM #	ROOM DESCRIPTION	# LAMPS
13C-21	PATIENT BED ROOM	2
13C-22	REST ROOM	1
13C-23	PATIENT BED ROOM	2
13C-24	PATIENT BED ROOM	2
13C-25	R/R & SHOWER	2
13C-26	STORAGE ROOM	1
13C-27	R/R & SHOWER	2
13C-28	PATIENT BED ROOM	2
13C-29	PATIENT BED ROOM	2
13C-30	R/R & SHOWER	2
13C-31	SHOWER ROOM	2
13C-32	PATIENT BED ROOM	2
13C-33	REST ROOM	1
13C-34	STORAGE ROOM	1
13C-35	R/R & SHOWER	2
13C-36	PATIENT BED ROOM	2
13C-37	PATIENT BED ROOM	2
13C-38	REST ROOM	1
13C-45	NURSE'S LOCKER	1
13C-46	REST ROOM	1
13C-52	SHOWER ROOM	2
	TOTAL	1258

LT 4 - ~~EE~~ 4

CONSTRUCTION COST ESTIMATE

Project:	ECO #LT4C1 Retrofit Restroom Incandescents with Compact Fluorescents	RS&H No.:	694-1331-005
Location:	Fort Gordon, GA	Date:	7/1/96
Basis:	Schematic Design	Estimator:	P. HUTCHINS
Building:	Eisenhower Army Medical Center	Filename:	EST.LT4C1.XLS

ITEM DESCRIPTION	QUANTITY No.	Unit	MATERIAL/EQUIP $/Unit	Total	LABOR $/Unit	Total	TOTAL COST	SOURCE Material	Labor
15-watt Compact Fluorescent	1258	ea	$22.21	$27,940	$0.69	$866	$28,806	Gp863	MEp238
Type SLS15									
Subtotal Bare Costs				$27,940		$866	$28,806		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$27,940		$866	$28,806		
City Cost Index (Aug. GA)			0%	$0	-46%	($398)	($398)	MMp533	MMp533
				-		-	-		
Subtotal				$27,940		$468	$28,408		
OH & Profit Markups			10%	$2,794	53%	$248	$3,042	MMp7	MMp475
				-		-	-		
Subtotal				$30,734		$716	$31,450		
Sales Taxes			6.0%	$1,844		NA	$1,844	MMp476	
				-		-	-		
Subtotal				$32,578		$716	$33,294		
Contingency			10%	$3,258	10%	$72	$3,330	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$35,836		$788	$36,624		
Design Fee				NA	6.0%	$1,998	$1,998		
SIOH				NA	6.0%	$1,998	$1,998		
				-		-	-		
Total Project Cost				$35,836		$4,784	$40,620		

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###.
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###
Dp###	2/94 DGSC Energy Efficient Lighting, page ###

LT4-14d

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: LT4C
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-LT4C RETROFIT WITH COMPACT FLUORESCENTS
FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION 1 - RESTROOMS
ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 36600.	
B. SIOH	$ 2196.	
C. DESIGN COST	$ 2196.	
D. TOTAL COST (1A+1B+1C)	$ 40992.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 40992.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	231.	$ 1760.	13.68	$ 24080.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		231.	$ 1760.		$ 24080.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 8537.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 110127.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 110127.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 10297.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.98 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 134207.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 3.27
(IF < 1 PROJECT DOES NOT QUALIFY)

**** Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

RS&H

SUBJECT _____ AEP NO _____

DESIGNER Hutchins SHEET _____ OF _____

CHECKER _____ DATE 3/14/96

DATE _____

LT4C2 Compact Fluorescents in Lobby Area Downlights

Replace existing 52-w incandescent with 18-watt compact with reflector

Bulb	watt	lumens	life	Price
A19 (inc.)	52	800	1000	$0.69 (1)
SL18/R40 (fl.)	18	800	10,000	$27.22 (2)

Annual operating hrs.

10 hrs/da * 7 da/wk = 3640 hrs/yr.

Savings: $\frac{(52-18) * 3640 * 31}{1000}$ = 3837 kwh/yr

31 lamps = 13 MBtu/yr.

Replacement cost savings for 31 lamps

$\frac{31 * 3640}{1000} * 7.57 - \frac{31 * 3640}{10,000} * 29.09$ = $525 /yr.

(1) Grainger p. 345

(2) Gp 863

(3) Labor cost = $\frac{45 \text{ min/lamps}^{3} * \$27.50}{60 \text{ min/hr}}$ = $\frac{\$6.88}{\text{lamp}}$

Spot relamp 3 at a time

CONSTRUCTION COST ESTIMATE

Project: ECO #LT4C2 Retrofit Downlight Incandescents with Compact Fluorescents
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 7/1/96
Estimator: P. HUTCHINS
Filename: ESTLT4C2.XLS

ITEM DESCRIPTION	QUANTITY No.	Unit	MATERIAL/EQUIP $/Unit	Total	LABOR $/Unit	Total	TOTAL COST	SOURCE Material	Labor
18-watt Compact Fluorescent	31	ea	$27.22	$844	$0.69	$21	$865	Gp863	MEp238
Type SL18/R40									
Subtotal Bare Costs				$844		$21	$865		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$844		$21	$865		
City Cost Index (Aug. GA)			0%	$0	-46%	($10)	($10)	MMp533	MMp533
				-		-	-		
Subtotal				$844		$11	$855		
OH & Profit Markups			10%	$84	53%	$6	$90	MMp7	MMp475
				-		-	-		
Subtotal				$928		$17	$945		
Sales Taxes			6.0%	$56		NA	$56	MMp476	
				-		-	-		
Subtotal				$984		$17	$1,001		
Contingency			10%	$98	10%	$2	$100	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$1,082		$19	$1,101		
Design Fee				NA	6.0%	$60	$60		
SIOH				NA	6.0%	$60	$60		
				-		-	-		
Total Project Cost				$1,082		$139	$1,221		

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###.
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###
Dp###	2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: LT4C
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-LT4C RETROFIT WITH COMPACT FLUORESCENTS
FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION 2 - LOBBY DOWNLIGHTS
ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 1100.	
B. SIOH	$ 66.	
C. DESIGN COST	$ 66.	
D. TOTAL COST (1A+1B+1C)	$ 1232.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 1232.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	13.	$ 99.	13.68	$ 1355.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		13.	$ 99.		$ 1355.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 525.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 6773.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)	$ 6773.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))	$ 624.
5. SIMPLE PAYBACK PERIOD (1G/4)	1.97 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	$ 8128.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= (IF < 1 PROJECT DOES NOT QUALIFY)	6.60
8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	14.95 %

RS&H

SUBJECT _____ AEP NO _____

_____ SHEET _____ OF _____

DESIGNER _____ DATE _____

CHECKER _____ DATE _____

ECO MI3B Occupancy Sensors in Breakrooms

Other similar rooms include:
lounges, kitchens, conference rooms, utility rooms, janitors closet, etc.

Total Load = 38.3 kw (see spreadsheet)
Operating hours = 168 hrs/wk
Proposed op hrs = 21 hrs/wk

Savings = $(168 - 21)\ hr/wk \times 52\ wk/yr \times 38.3\ kW = 292{,}765\ kwh$

$= 999\ MBtu/yr.$

FT GORDON EISENHOWER ARMY MEDICAL CENTER

SURVEY OF LIGHTS FOR INSTALLING OCCUPANCY SENSORS

ROOM #	ROOM DESCRIPTION	# FLUOR. 'U' L FIX.	# FLUOR. 8 L FIX.	# FLUOR 4 L' FIX.	# FLUOR. 2 L FIX.	# FLUOR. 1 L FIX.	# SWITCHES
1B-03	EXAMINATION ROOM			2			1
1B-06	EXAMINATION ROOM			2			1
1B-08	EXAMINATION ROOM			2			1
1B-10	EXAMINATION ROOM			2			1
1B-13	EXAMINATION ROOM			2			1
1B-15	EXAMINATION ROOM			2			1
1B-17	EXAMINATION ROOM			2			1
1B-19	EXAMINATION ROOM			2			1
1B-21	EXAMINATION ROOM			2			1
1B-27	EXAMINATION ROOM			2			1
1B-30	EXAMINATION ROOM			2			1
1B-33	EXAMINATION ROOM			2			1
1B-44	EXAMINATION ROOM			2			1
1B-51	EXAMINATION ROOM				4		1
1B-54	EXAMINATION ROOM				2		1
1D-04	EXAMINATION ROOM			2			1
1D-08	EXAMINATION ROOM			2			1
1D-11	EXAMINATION ROOM			2			1
1D-12	EXAMINATION ROOM			2			1
1D-15	EXAMINATION ROOM			2			1
1D-18	EXAMINATION ROOM			2			1
1D-20	EXAMINATION ROOM			2			1
1D-21	X-RAY EXAM RM			2			1
1D-22	EXAMINATION ROOM			2			1
1D-24	EXAMINATION ROOM			2			1
1D-27	EXAMINATION ROOM			2			1
1D-29	EXAMINATION ROOM			2			1
1D-31	EXAMINATION ROOM			2			1
1D-35	EXAMINATION ROOM			2			1
1D-57	EXAMINATION ROOM			2			1
1D-59	EXAMINATION ROOM			2			1
1D-68	EXAMINATION ROOM			2			1
1E-05	EXAMINATION ROOM			2			1
1J-24	BREAK ROOM				1		1
1L-17	BREAK ROOM		3				1
FP003	EXAMINATION ROOM			2			1
FP005	EXAMINATION ROOM			2			1
FP006	EXAMINATION ROOM			2			1
FP007	EXAMINATION ROOM			2			1
FP008	EXAMINATION ROOM			2			1
FP009	EXAMINATION ROOM			2			1
FP010	EXAMINATION ROOM			2			1
FP018	EXAMINATION ROOM			2			1
FP019	EXAMINATION ROOM			2			1
FP020	EXAMINATION ROOM			2			1
FP021	EXAMINATION ROOM			2			1
FP022	EXAMINATION ROOM			2			1
FP023	EXAMINATION ROOM			2			1
FP029	EXAMINATION ROOM			2			1
FP030	EXAMINATION ROOM			2			1
FP031	EXAMINATION ROOM			2			1
FP032	EXAMINATION ROOM			2			1
FP033	EXAMINATION ROOM			2			1
FP034	EXAMINATION ROOM			2			1
FP043	EXAMINATION ROOM			2			1
FP044	EXAMINATION ROOM			2			1
FP045	EXAMINATION ROOM			2			1
FP046	EXAMINATION ROOM			2			1
FP047	EXAMINATION ROOM			2			1
FP048	EXAMINATION ROOM			2			1
FP056	SOILED UTILITY RM				2		1
FP059	EXAMINATION ROOM			2			1
FP060	EXAMINATION ROOM			2			1
FP061	EXAMINATION ROOM			2			1
FP062	EXAMINATION ROOM			2			1
FP063	EXAMINATION ROOM			2			1
FP064	EXAMINATION ROOM			2			1
FP069	EQ ST /LINEN/CL U				3		1
FP075	EXAMINATION ROOM			2			1
FP076	EXAMINATION ROOM			2			1
FP077	EXAMINATION ROOM			2			1
FP078	EXAMINATION ROOM			2			1
FP079	EXAMINATION ROOM			2			1
FP080	EXAMINATION ROOM			2			1
FP116	CONFERENCE ROOM				8		1
FP118	R/R & LOCKER RM				4		1
FP119	R/R & LOCKER RM				4		1
FP121	STAFF LOUNGE				2		1
FP129	STUDENT ROOM				6		1

MI3-3a

ROOM #	ROOM DESCRIPTION	# FLUOR U L FIX.	# FLUOR 8 L FIX.	# FLUOR 4 L FIX.	# FLUOR 2 L FIX.	# FLUOR 1 L FIX.	# SWITCHES
2B-02	EXAMINATION ROOM			2			1
2B-04	EXAMINATION ROOM			2			1
2B-06	EXAMINATION ROOM			2			1
2B-08	EXAMINATION ROOM			2			1
2B-10	EXAMINATION ROOM			2			1
2B-13	STAFF LOUNGE			2			1
2B-19	EXAMINATION ROOM			2			1
2B-21	EXAMINATION ROOM			2			1
2B-22	UTILITY ROOM				2		1
2B-23	EQUIPMENT ROOM				2		1
2B-24	EXAMINATION ROOM			2			1
2B-26	EXAMINATION ROOM			2			1
2B-27	EXAMINATION ROOM			2			1
2B-29	EXAMINATION ROOM			2			1
2B-36	EXAMINATION ROOM			2			1
2B-40	KITCHEN			2			1
2B-XX	BREAK RM				2		1
2D-18	BREAK ROOM			1			1
2D-23	EXAMINATION ROOM			2			1
2D-26	EXAMINATION ROOM			2			1
2D-28	EXAMINATION ROOM			2			1
2D-30	EXAMINATION ROOM			2			1
2D-33	EXAMINATION ROOM			2			1
2D-35	EXAMINATION ROOM			2			1
2D-36	EXAMINATION ROOM			2			1
2D-38	EXAMINATION ROOM			2			1
2D-40	EXAMINATION ROOM			2			1
2D-41	EXAMINATION ROOM			2			1
2D-43	EXAMINATION ROOM			2			1
2D-45	EXAMINATION ROOM			2			1
2D-48	EXAMINATION ROOM			2			1
2D-50	EXAMINATION ROOM			2			1
2D-58	EXAMINATION ROOM			2			1
2D-60	EXAMINATION ROOM			2			1
2D-62	EXAMINATION ROOM			2			1
2E-07	EXAMINATION ROOM			3			1
2E-08	EXAMINATION ROOM			3			1
2E-09	EXAMINATION ROOM			3			1
2E-11	EXAMINATION ROOM			3			1
2E-12	BREAK ROOM				2		1
2E-21	EXAMINATION ROOM			3			1
2E-22	EXAMINATION ROOM			3			1
2E-23	EXAMINATION ROOM			3			1
2E-24	EXAMINATION ROOM			3			1
2F-12	EXAMINATION ROOM			2			1
2F-14	EXAMINATION ROOM			2			1
2F-17	EXAMINATION ROOM			2			1
2F-20	EXAMINATION ROOM			2			1
2F-21	EXAMINATION ROOM			2			1
2F-24	EXAMINATION ROOM			2			1
2F-25	EXAMINATION ROOM			2			1
2F-28	EXAMINATION ROOM			2			1
2F-29	EXAMINATION ROOM			2			1
2F-32	EXAMINATION ROOM			2			1
2F-33	EXAMINATION ROOM			2			1
2F-38	EXAMINATION ROOM			2			1
2F-39	EXAMINATION ROOM			2			1
2F-40	EXAMINATION ROOM			2			1
2G-06	EXAMINATION ROOM			2			1
2I-08	EXAMINATION ROOM			2			1
2I-10	EXAMINATION ROOM			2			1
2I-18	EXAMINATION ROOM			2			1
2I-20	EXAMINATION ROOM			2			1
2I-22	EXAMINATION ROOM			2			1
2J-05	EXAMINATION ROOM			2			1
2J-07	EXAMINATION ROOM			2			1
2J-12	EXAMINATION ROOM			2			1
2J-13	EXAMINATION ROOM			2			1
2J-15	EXAMINATION ROOM			2			1
2K-01	LOCKER ROOM	3					1
2K-05	LOUNGE				7		1
2N-05	EXAMINATION ROOM			2			1
2N-07	EXAMINATION ROOM			2			1
2N-08	EXAMINATION ROOM			2			1
2O-19	SUPPLY ROOM				2		1
2O-23	EXAMINATION ROOM			2			1
2O-25	EXAMINATION ROOM			2			1
2O-27	EXAMINATION ROOM			2			1
2O-34	BREAK ROOM				1		1
2O-50	CONFERENCE ROOM			6			1
2P-05	EXAMINATION ROOM			2			1
2P-07	EXAMINATION ROOM			2			1
2P-09	EXAMINATION ROOM			2			1
2P-11	EXAMINATION ROOM			2			1
2P-34	EXAMINATION ROOM			2			1
2P-36	EXAMINATION ROOM			2			1
2P-40	EXAMINATION ROOM			2			1
2P-42	EXAMINATION ROOM			2			1
2P-44	EXAMINATION ROOM			2			1
2Q-01	CONFERENCE ROOM				2		1
2R-25	PRINTER ROOM				4		1

ROOM #	ROOM DESCRIPTION	# FLUOR 'U' L FIX.	# FLUOR 8 L FIX.	# FLUOR. 4 L FIX.	# FLUOR 2 L FIX.	# FLUOR. 1 L FIX.	# SWITCHES
3B-14	LOCKER ROOM				3		1
3B-17	LOCKER ROOM					8	1
3E-08	LOCKER ROOM				1		1
3F-03	LOCKER ROOM				1		1
3I-08	R/R & LOCKER RM				1		1
3I-11	PASSAGE TO LK RM				4		1
3I-12	LOCKER ROOM				2		1
3K-05	LOCKER ROOM				1		1
3K-23	LOCKER ROOM				1		1
3K-24	PASSAGE TO LOCKER				3		1
3K-25	LOUNGE				3		1
3K-26	LOCKER RM & SHOWER				3		1
3K-27	LOCKER ROOM				1		1
3K-29	PASSAGE TO LOCKER				3		1
3L-04	UTILITY RM				1		1
4C-12	BREAK ROOM				1		1
4C-18	CONFERENCE ROOM				10		1
5A-13	SOILED UTILITY ROOM				2		1
5A-14	CLEAN UTILITY ROOM				2		1
5A-18	MONIT. STORAGE RM				2		1
5A-19	UTILITY/EQUIP. STOR.				2		1
5B-17	COMPUTER ROOM				2		1
5B-40	CONFERENCE ROOM			4			1
5B-41	LOCKER ROOM				2		1
5C-37	KITCHEN			1			1
5C-38	SUPPLY ROOM			1			1
5C-44	KITCHEN			1			1
5B-03	WAITING AREA	2			4		1
6A-30	CONF./CLASS ROOM				4		1
6A-31	CONTROL ACCESS				6		1
6A-35	BREAK ROOM				6		1
6A-40	SCRUB				2		1
6A-49	SOILED UTILITY ROOM	3					1
6A-50	CLEAN UTILITY ROOM	3					1
6A-53	CLEAN UTILITY ROOM				2		1
6B-16	MICROSCOPE ROOM				4		1
6B-41	EXAMINATION ROOM				2		1
6B-43	LOCKER ROOM				3		2
6B-46	SUPPLY ROOM				2		1
6C-14	CONFERENCE ROOM				4		1
6C-21	UV LIGHT ROOM			1			1
6C-27	SOILED UTILITY ROOM				2		1
6C-28	CLEAN UTILITY ROOM				1		1
6C-39	KITCHEN			1			1
7A-01	CONFERENCE ROOM				4		1
7A-46	KITCHEN			1			1
7A-53	SOILED UTILITY ROOM				3		1
7A-54	STAFF LOUNGE				3		1
7B-06	WAITING AREA	2			8		2
7B-11	BREAK ROOM/LOUNGE			1	4		2
7C-45	SOILED UTILITY ROOM				3		1
7C-46	CLEAN UTILITY ROOM				3		1
7C-53	KITCHEN			1			1
8A-01	CONFERENCE ROOM				4		1
8A-46	KITCHEN			1			1
8A-53	SOILED UTILITY ROOM				3		1
8A-54	CLEAN UTILITY ROOM				3		1
8B-06	VISITORS' WAITING ROOM				6		2
8B-45	BREAK ROOM/LOUNGE			2			1
8C-45	SOILED UTILITY ROOM				3		1
8C-46	CLEAN UTILITY ROOM				3		1
8C-53	KITCHEN			1			1
9A-46	KITCHEN			1			1
9A-53	SOILED UTILITY ROOM				3		1
9A-54	CLEAN UTILITY ROOM				3		1
9B-06	VISITORS' WAITING ROOM				12		2
9B-40	BREAK RM/LOCKER				2		1
9C-45	SOILED UTILITY ROOM				3		1
9C-46	CLEAN UTILITY ROOM				3		1
9C-53	KITCHEN			1			1
10A-01	CONFERENCE ROOM				4		1
10A-46	KITCHEN			1			1
10A-53	SOILED UTILITY ROOM				3		1
10A-54	CLEAN UTILITY ROOM				3		1
10B-06	VISITORS' WAITING ROOM				6		2
10C-45	SOILED UTILITY ROOM				3		1
10C-46	BREAK ROOM				3		1
10C-51	PRINTER ROOM	2					1
10C-53	KITCHEN			1			1

ROOM #	ROOM DESCRIPTION	# FLUOR. 'U' L FIX.	# FLUOR. 8 L FIX.	# FLUOR. 4 L FIX.	# FLUOR. 2 L FIX.	# FLUOR. 1 L FIX.	# SWITCHES	# LIGHTS ALWAYS ON	PICTURE #
11A-46	KITCHEN			1			1		
11A-47	STORAGE ROOM				1		1		
11A-53	SOILED UTILITY ROOM				3		1		
11A-54	CLEAN UTILITY ROOM				3		1		
11B-06	VISITORS' WAITING ROOM				8		2		
11B-16	SUPPLY ROOM				2		1		
11B-40	BREAK ROOM				2		1		
11C-21	CONFERENCE ROOM				4		1		
11C-45	SOILED UTILITY ROOM				3		1		
11C-46	CLEAN UTILITY ROOM				3		1		
11C-53	KITCHEN			1			1		
12A-42	KITCHEN				1		1		
12A-49	SOILED UTILITY ROOM				3		1		
12A-50	CHART ROOM				3		1		
12B-04	GROUP THERAPY ROOM				12		1		
12B-17	EXAMINATION ROOM			2			1		
12B-40	GROUP THERAPY ROOM				3		1		33
12C-44	KITCHEN			1			1		
12C-44	KITCHEN			1			1		
13A-43	KITCHEN			1			1		
13A-50	SOILED UTILITY ROOM				3		1		
13A-51	CLEAN UTILITY ROOM				3		1		
13B-04	WAITING AREA				11		1		
13B-14	EXAMINATION ROOM			2			1		
13C-43	KITCHEN			1			1		
13C-50	CLEAN UTILITY ROOM				2		1		
13C-52	SOILED UTILITY ROOM				2		1		
	TOTAL	15	3	339	323	8	283		
Totals	watts/fixture	90	360	180	90	45			
	kW	1.4	1.1	61.0	29.1	0.4			92.9
Exam Rooms									
	Fixtures	0	0	300	6	0	150		
	kW	0	0	54	0.54	0			54.5
	Breakrooms, kit, util, etc	15	3	39	317	8	127		
	kW	1.35	1.08	7.02	28.53	0.36			38.3

CONSTRUCTION COST ESTIMATE

Project:	ECO # MI3B Install Occupancy Sensors in Breakrooms	RS&H No.:	694-1331-005
Location:	Fort Gordon, GA	Date:	7/1/96
Basis:	Schematic Design	Estimator:	P. HUTCHINS
Building:	Eisenhower Army Medical Center	Filename:	ESTMI3B.XLS

	QUANTITY		MATERIAL/EQUIP		LABOR		TOTAL	SOURCE	
ITEM DESCRIPTION	No.	Unit	$/Unit	Total	$/Unit	Total	COST	Material	Labor
Occupancy Sensor,	127	ea	$56.11	$7,126	$33.50	$4,255	$11,381	Dp61,107	MEp239
ceiling mounted									
Power pack	127	ea	$17.54	$2,228	$23.50	$2,985	$5,213	Dp61,107	MEp239
Mounting bracket	127	ea	$2.45	$311			$311	Dp61,107	
Subtotal Bare Costs				$9,665		$7,240	$16,905		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$9,665		$7,240	$16,905		
City Cost Index (Aug. GA)			0%	$0	-46%	($3,330)	($3,330)	MMp533	MMp533
				-		-	-		
Subtotal				$9,665		$3,910	$13,575		
OH & Profit Markups			10%	$967	53%	$2,072	$3,039	MMp7	MMp475
				-		-	-		
Subtotal				$10,632		$5,982	$16,614		
Sales Taxes			6.0%	$638		NA	$638	MMp476	
				-		-	-		
Subtotal				$11,270		$5,982	$17,252		
Contingency			10%	$1,127	10%	$598	$1,725	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$12,397		$6,580	$18,977		
Design Fee				NA	6.0%	$1,035	$1,035		
SIOH				NA	6.0%	$1,035	$1,035		
				-		-	-		
Total Project Cost				$12,397		$8,650	$21,047		

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###.
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###
Dp###	2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: MI3
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS
FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION B - BREAKROOMS
ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 19000.	
B. SIOH	$ 1140.	
C. DESIGN COST	$ 1140.	
D. TOTAL COST (1A+1B+1C)	$ 21280.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 21280.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	999.	$ 7612.	13.68	$ 104137.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		999.	$ 7612.		$ 104137.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 7612.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.80 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 104137.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 4.89
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 13.24 %

CONSTRUCTION COST ESTIMATE

Project:	ECO # MI3C Install Wall Switch Occupancy Sensors	RS&H No.:	694-1331-005
Location:	Fort Gordon, GA	Date:	3/8/96
Basis:	Schematic Design	Estimator:	P. HUTCHINS
Building:	Eisenhower Army Medical Center	Filename:	ESTMI3C.XLS

	QUANTITY		MATERIAL/EQUIP		LABOR		TOTAL	SOURCE	
ITEM DESCRIPTION	No.	Unit	$/Unit	Total	$/Unit	Total	COST	Material	Labor
Occupancy Sensor,	100	ea	$44.42	$4,442	$9.75	$975	$5,417	Dp61,107	MEp239
wall switch									
Subtotal Bare Costs				$4,442		$975	$5,417		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$4,442		$975	$5,417		
City Cost Index (Aug. GA)			0%	$0	-46%	($449)	($449)	MMp533	MMp533
				-		-	-		
Subtotal				$4,442		$526	$4,968		
OH & Profit Markups			10%	$444	53%	$279	$723	MMp7	MMp475
				-		-	-		
Subtotal				$4,886		$805	$5,691		
Sales Taxes			6.0%	$293		NA	$293	MMp476	
				-		-	-		
Subtotal				$5,179		$805	$5,984		
Contingency			10%	$518	10%	$81	$599	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$5,697		$886	$6,583		
Design Fee				NA	6.0%	$359	$359		
SIOH				NA	6.0%	$359	$359		
				-		-	-		
Total Project Cost				$5,697		$1,604	$7,301		

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###.
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###
Dp###	2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: MI3
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS
FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION C - OFFICES
ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 6700.		
B. SIOH	$ 402.		
C. DESIGN COST	$ 402.		
D. TOTAL COST (1A+1B+1C)	$ 7504.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 7504.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	28.	$ 213.	13.68	$ 2919.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		28.	$ 213.		$ 2919.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) — $ 0.
(1) DISCOUNT FACTOR (TABLE A) — 12.90
(2) DISCOUNTED SAVING/COST (3A X 3A1) — $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 213.

5. SIMPLE PAYBACK PERIOD (1G/4) 35.17 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 2919.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= .39
(IF < 1 PROJECT DOES NOT QUALIFY)

CONSTRUCTION COST ESTIMATE

Project:	ECO # MI3D Install Wall Switch Occupancy Sensors - Exam Rms	RS&H No.:	694-1331-005
Location:	Fort Gordon, GA	Date:	7/1/96
Basis:	Schematic Design	Estimator:	P. HUTCHINS
Building:	Eisenhower Army Medical Center	Filename:	ESTMI3D.XLS

	QUANTITY		MATERIAL/EQUIP		LABOR		TOTAL	SOURCE	
ITEM DESCRIPTION	No.	Unit	$/Unit	Total	$/Unit	Total	COST	Material	Labor
Occupancy Sensor,	100	ea	$44.42	$4,442	$9.75	$975	$5,417	Dp61,107	MEp239
wall switch									
Subtotal Bare Costs				$4,442		$975	$5,417		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$4,442		$975	$5,417		
City Cost Index (Aug. GA)			0%	$0	-46%	($449)	($449)	MMp533	MMp533
				-		-	-		
Subtotal				$4,442		$526	$4,968		
OH & Profit Markups			10%	$444	53%	$279	$723	MMp7	MMp475
				-		-	-		
Subtotal				$4,886		$805	$5,691		
Sales Taxes			6.0%	$293		NA	$293	MMp476	
				-		-	-		
Subtotal				$5,179		$805	$5,984		
Contingency			10%	$518	10%	$81	$599	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$5,697		$886	$6,583		
Design Fee				NA	6.0%	$359	$359		
SIOH				NA	6.0%	$359	$359		
				-		-	-		
Total Project Cost				$5,697		$1,604	$7,301		

LEGEND:

MMp###	1996 Means Mechanical Cost Data, page ###
MEp###	1996 Means Electrical Cost Data, page ###.
Gp###	1995 Grainger, page ###
Dp###	2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: MI3
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS
FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION D - EXAM ROOMS
ANALYSIS DATE: 07-01-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 6600.	
B. SIOH	$ 396.	
C. DESIGN COST	$ 396.	
D. TOTAL COST (1A+1B+1C)	$ 7392.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 7392.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	62.	$ 472.	13.68	$ 6463.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		62.	$ 472.		$ 6463.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) — $ 0.
(1) DISCOUNT FACTOR (TABLE A) — 12.90
(2) DISCOUNTED SAVING/COST (3A X 3A1) — $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) $ 0.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) $ 472.

5. SIMPLE PAYBACK PERIOD (1G/4) 15.65 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) $ 6463.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= .87
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 3.90 %

MOTOROLA
Motorola Lighting Inc.

TECHNICAL BULLETIN

VOLUME 5
NUMBER 1

HIGH FREQUENCY FLUORESCENT BALLASTS AND INRUSH CURRENT

This technical bulletin discusses the operation of electronic fluorescent ballasts and the generation of inrush or backrush currents in the AC power distribution system. Information presented explains the cause of inrush or backrush current. A properly designed system is able to accommodate inrush or back rush currents. A chart of system component selection guidelines is provided at the end of this document.

Every electrical or electronic device uses power in order to function. This power is obtained from the AC power distribution system and is referred to as a specific amount of current in amperes or amps, at the power line voltage of 120 volts or 277 volts. The current which is required during constant-on operation is called "steady state current" and does not change once the device has reached level operation.

During the start-up period, some electronic devices such as personal computers, fax machines, or electronic ballasts, require a momentary, higher level of current in order to charge a capacitor. This short, increase in current level lasts up to five one-thousands of a second (0.005sec) and is called "inrush current". Capacitors are needed in the device's power supply to provide energy to the load when the line voltage is near or at zero (which occurs 120 times a second).

Some electronic ballasts use an inductor at the front end of their power supply to control performance characteristics. If an inductor is used, a condition called "backrush, or, "back Electro-Magnetic Force (EMF)", may occur. Back EMF may cause a large spike of current to occur when the electronic device is turned off.

Electronic ballasts typically contain capacitors or inductors in the front end of their power supplies. This will increase the likelihood of either inrush or backrush occurring. If either condition occurs, and the auxiliary equipment has not been designed to withstand either inrush or backrush, then the auxiliary equipment's life or function may be impaired. Auxiliary equipment includes circuit breakers, energy management control relays, occupancy sensors, and wall switches.

In addition, some ballasts which are advertised as having low inrush do so by using a negative resistance component called a thermistor to limit initial current. As the thermistor heats up, its resistance decreases and it assumes a passive role in the operation of the ballast. However if for any reason the power to the ballast circuit is momentarily interrupted, the thermistor will still be at its hot, low resistance level and will be ineffective in limiting inrush current.

Peak circuit inrush is less than the sum of the inrush of all the ballasts in the circuit because of the limiting effect of line impedance (line sag). Each ballast has a typical inrush time of about 0.5 to 1.0 milliseconds (0.0005 to 0.001seconds), and the total circuit in-rush time is about 2.5 milliseconds.

Since inrush varies model by model even for a given ballast manufacturer, contrary to what some have been led to believe, selecting an electronic ballast with a higher percentage value for total harmonic distortion (THD) will not insure that the selected ballast has a low inrush value. For example, the Motorola Lighting Inc. M2-IN-T8-277 ballast model (less than 10% THD) has a very low inrush of less than 5 amps, while the measured inrush current of most other instant start 277 volt ballasts in the marketplace (THD between 10% and 20%) is higher.

Each ballast manufacturer should be consulted for quantitative inrush and backrush information regarding their specific products and the lighting system designer should take these characteristics into account during the design phase of the system.

Inrush or backrush current, if not considered during system design, could possibly, in some isolated situations, cause false tripping of circuit breakers or welding of contacts in relays, sensors or switches. However, an industrial series circuit breaker can withstand 500 amps for a time interval up to one cycle, or 16.667 milliseconds, and therefore, will not be affected by inrush. Use of relays having industrial ratings addressed in the attached chart will eliminate the possibility of relay contacts welding due to inrush.

The only appropriate way in which to address inrush or backrush current is to do so at a system level by selecting components which are designed to function reliably with these loads. The following system or component design guidelines should be followed in order to provide a reliable system.

System Component Guidelines

COMPONENT OR CHARACTERISTIC	DESCRIPTION
Wire Size	Number 12 AWG, 600 volt insulation, wire should be used between the luminaire and the energy management control relays, occupancy sensors, or wall switches. Number 18 AWG solid copper wire should always be used within the luminaire for all ballast connections.
Max. Input Power Level	The continuous load must not exceed 16 amperes (80% of the typical component rating of 20 amperes)
Circuit Breaker	Use a heavy-duty industrial grade breaker that can withstand a peak of 50 to 100 times its ampere rating for 1/4 of a cycle
Control Relay	Mechanical relays must be industrial grade rated for 20 amperes resistive and inductive lighting loads at 120 and 277 volts. The relay should be rated for a minimum of 30,000 operations, and shall be UL listed and CSA certified. The relay must withstand 1000 ampere in-rush. Relay contacts must be silver alloy material and contain bifurcated coil to prevent damage from continuous on and off signals.
Wall Switch or Wallbox Dimmers	Switches of dimmers must be industrial grade and rated for 20 amperes at 120 and 277 volts alternating current, and 1 HP at 120 volts and 2 HP at 240 volts. Switches must have silver alloy contacts. Switches must be UL. Listed, CSA Certified, comply with UL 20, and meet Federal specification WS-896.

Always consult your ballast manufacturer for more specific instructions and design requirements prior to installation. For additional information on inrush currents of Motorola Lighting Inc. electronic ballasts, please call **1-800-MLI-0089.**

Inrush Current

There has been much discussion in the last few months regarding high inrush currents being associated with high frequency electronic ballasts. Following is a technical overview of the subject.

What is it?

Devices with solid state power supplies, such as computers, copiers, and electronic ballasts, as well as many magnetic devices such as motors, drives, and core & coil ballasts, have an input current during initial start-up that can be several times greater than their operating or steady-state current. This current during start-up is generally referred to as *Inrush Current*. For High Frequency Electronic Ballasts, this current during start-up typically lasts for much less than 1/2 of a 60 Hz cycle (<8 msec).

What are the effects?

High current conditions can affect electrical system components. The main area of concern is the tripping of circuit breakers and fuses. If the circuit breaker or fuse is not designed to handle the amount of inrush current that is present, the device could trip upon energizing the circuit or during circuit operation.

It has been suggested that during turn-on, momentary contact bouncing in the switch or relay may cause the contacts to become pitted due to arcing between the contacts points. This can be present in all systems, and is not a direct result of inrush current. However, the higher the overall system current, the faster contact deterioration may occur.

Since inrush current is only present during initial system energization, it is not a factor during system turn-off.

What amount is present in your lighting system?

Inrush current is present in both magnetic and electronic ballasts. The amount of ballast inrush current varies across manufacturers, ballast types, and ballast brands. In addition, the inrush current of a complete lighting circuit is affected by the total source impedance of the entire distribution system. A system with a low impedance can deliver a greater amount of inrush current to the ballast(s) than a circuit with a high impedance.

The system impedance is determined by several electrical distribution system variables. These variables include the impedance of the main transformer; the distance of the lighting circuit to the main transformer; the type and size of wire between the branch circuit and transformer; the wire size and wire type of the lighting branch circuit, and the length of the wires in the lighting branch circuit. These variables determine the maximum amount of current that can be delivered to the ballast(s) at the moment of turn-on.

Electronic ballasts are generally characterized into two groups, those with an *active* front-end, and those with a *passive* front-end. The term *front-end* refers to the power input section of the ballast.

Generally, electronic ballasts with *active* front ends have Total Harmonic Distortion below 10%, and *passive* front ends typically have THD below 20%. However, due to multiple circuit designs, and the continuous design changes that are evolving, this may not always be the case.

The *active* ballasts typically have low impedance during start-up, due to the need to charge the system circuitry. Many *passive* ballasts typically have an inductive choke on the front-end, which has a higher impedance, resulting in a lower inrush current. *Active* electronic ballasts can have inrush currents as high as 100 times or more its operating current, with a duration of up to .8 milliseconds. *Passive* electronic ballasts with an input choke can have an inrush current of up to 30 times operating current, with a duration up to 5 milliseconds. This is compared to magnetic ballasts that have an inrush current of up to 10 times the operating current, with a duration of under 10 milliseconds.

Based on the assumption of inrush current being 100 times the magnitude of the steady state current, a 20 amp circuit loaded to 16 amps could have an inrush current as high as 1600 amps (16 x 100). However, due to system impedances the total system inrush will probably not reach the theoretical maximum calculated.

Previous laboratory testing of sample ballasts has shown an inrush current of 75 amps on a 120V, 20 amp system loaded to 16 amps with two-lamp *active* electronic ballasts. Total duration was approx. 5 milliseconds.

These lab results show a significantly lower circuit inrush current, with a greater duration, than the theoretical calculations for a single ballast predict. These results are only valid for one type of ballast in a controlled environment, and extrapolation to any other location is not possible without first investigating all system parameters. All things considered, the likelihood of achieving the maximum inrush is probably very slight.

What can you do?

When planning a new or retrofit ballast installation, take the following steps in order to reduce potential inrush current problems.

- ***First***, determine the inrush current drawn by the ballast you have selected. A range may be supplied by the manufacturer due to the various system impedances encountered in laboratory testing.
- ***Second***, calculate the theoretical maximum inrush current for the circuit based on the circuit values for your specific installation (wire size, length, etc.).
- ***Third***, select a fuse or circuit breaker that is capable of handling the inrush current for the duration of the inrush. Typically, fuses and breakers are rated to handle inrush currents that are several multiples of their steady-state ratings.
- ***Fourth***, select switches and contacts that are able to withstand the inrush current. All switches and contacts in the circuit, both locally and at the electrical or lighting panel, should be properly sized. Contact your switch manufacturer to determine the proper unit. If occupancy sensors or other control devices are to be used on the circuit, contact the sensor manufacturer to ensure compatibility with the type and number of ballasts being controlled.

For further information on the inrush current present in Advance electronic ballasts, please call Advance Technical Service at 1-800-372-3331.

Always follow the National Electric Code and state and local codes when designing and installing any lighting or electrical system.

This publication is intended to provide general educational and background information on the issue of inrush currents, and not definitive solutions to specific installation issues.

Michael J. Ostaffe
Electronic Product Manager
ADVANCE TRANSFORMER CO.

RS&H

Project Number _____

Telephone Call Confirmation

(800) 654-0089

Local _____ L.D. ✓ Placed _____ Rec'd _____ Date 2/12/96

Conversed with Robert Payne of Motorola Customer Service

Regarding In-rush current on low THD ballasts

Rob will send fax on this subject

Distribution:

MI3-17

EISENHOWER AMC
FT. GORDON, GA

SCREENING CALCULATIONS
OCCUPANCY SENSORS — ECO # MI3
FILENAME: OSENS.WK4

RESTROOMS ECO MI3A

# 2L FIXTS	KW	ENERGY USE (KWH) CURR.	PROP'D	ANNUAL SAVINGS (KWH)	($)	SIMPLE PAYBACK (YRS)
1	0.058	507	253	253	$6.59	25.2
2	0.116	1,013	507	507	$13.17	12.6
3	0.174	1,520	760	760	$19.76	8.4
4	0.232	2,027	1,013	1,013	$26.35	6.3
5	0.290	2,533	1,267	1,267	$32.93	5.0
6	0.348	3,040	1,520	1,520	$39.52	4.2

Assumptions:

Electricity avg. rate=	$0.026 c/kwh
Cost=	$166
Operating hrs=	168 hrs/wk
Proposed op hrs =	84.0 hrs/wk
Percent savings =	50%

BREAKROOMS MI3B

# 2L FIXTS	KW	ENERGY USE (KWH) CURR	PROP'D	ANNUAL SAVINGS (KWH)	($)	SIMPLE PAYBACK (YRS)
1	0.058	507	63	443	$11.53	14 4
2	0.116	1,013	127	887	$23 05	7 2
3	0.174	1,520	190	1,330	$34.58	4 8
4	0.232	2,027	253	1,773	$46.11	3.6
5	0.290	2,533	317	2,217	$57.64	2.9
6	0.348	3,040	380	2,660	$69.16	2.4

Assumptions:

Electricity avg. rate=	$0.026 c/kwh
Cost=	$166
Operating hrs=	168 hrs/wk
Proposed op hrs =	21.0 hrs/wk
Percent savings =	88%

OFFICES MI3C

# 2L FIXTS	KW	ENERGY USE (KWH) CURR.	PROP'D	ANNUAL SAVINGS (KWH)	($)	SIMPLE PAYBACK (YRS)
1	0.058	151	124	27	$0.71	80.8
2	0.116	302	247	54	$1.41	40.4
3	0.174	452	371	81	$2.12	26.9
4	0.232	603	495	109	$2.82	20.2
5	0.290	754	618	136	$3.53	16.2
6	0.348	905	742	163	$4 23	13 5

Assumptions:

Electricity avg. rate=	$0.026 c/kwh
Cost=	$57
Operating hrs=	50 hrs/wk
Proposed op hrs =	41.0 hrs/wk
Percent savings =	18%

EXAM ROOMS MI3D

# 2L FIXTS	KW	ENERGY USE (KWH) CURR.	PROP'D	ANNUAL SAVINGS (KWH)	($)	SIMPLE PAYBACK (YRS)
1	0.058	151	60	90	$2.35	24 2
2	0.116	302	121	181	$4.70	12 1
3	0.174	452	181	271	$7 06	8 1
4	0 232	603	241	362	$9 41	6 1
5	0 290	754	302	452	$11 76	4 8
6	0.348	905	362	543	$14 11	4 0

Assumptions:

Electricity avg rate=	$0.026 c/kwh
Cost=	$57
Operating hrs=	50 hrs/wk
Proposed op hrs =	20.0 hrs/wk
Percent savings =	60%

CONSTRUCTION COST ESTIMATE

Project: ECO # MI3A Install Occupancy Sensors in Restrooms
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 3/8/96
Estimator: P. HUTCHINS
Filename: ESTMI3A.XLS

ITEM DESCRIPTION	QUANTITY No.	Unit	MATERIAL/EQUIP $/Unit	Total	LABOR $/Unit	Total	TOTAL COST	SOURCE Material	Labor
Occupancy Sensor,	100	ea	$56.11	$5,611	$33.50	$3,350	$8,961	Dp61,107	MEp239
ceiling mounted									
Power pack	100	ea	$17.54	$1,754	$23.50	$2,350	$4,104	Dp61,107	MEp239
Mounting bracket	100	ea	$2.45	$245			$245	Dp61,107	
Subtotal Bare Costs				$7,610		$5,700	$13,310		
Retrofit Cost Factors			0%	$0	0%	$0	$0	MMp6	MMp6
				-		-	-		
Subtotal				$7,610		$5,700	$13,310		
City Cost Index (Aug. GA)			0%	$0	-46%	($2,622)	($2,622)	MMp533	MMp533
				-		-	-		
Subtotal				$7,610		$3,078	$10,688		
OH & Profit Markups			10%	$761	53%	$1,631	$2,392	MMp7	MMp475
				-		-	-		
Subtotal				$8,371		$4,709	$13,080		
Sales Taxes			6.0%	$502		NA	$502	MMp476	
				-		-	-		
Subtotal				$8,873		$4,709	$13,582		
Contingency			10%	$887	10%	$471	$1,358	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$9,760		$5,180	$14,940		
Design Fee				NA	6.0%	$815	$815		
SIOH				NA	6.0%	$815	$815		
				-		-	-		
Total Project Cost				$9,760		$6,810	$16,570		

LEGEND:

MMp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: MI3
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO-MI3 INSTALL OCCUPANCY SENSORS
FISCAL YEAR 1996 DISCRETE PORTION NAME: OPTION A - RESTROOMS
ANALYSIS DATE: 03-11-96 ECONOMIC LIFE 20 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 14900.		
B. SIOH	$ 894.		
C. DESIGN COST	$ 894.		
D. TOTAL COST (1A+1B+1C)	$ 16688.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT		$ 0.	
F. PUBLIC UTILITY COMPANY REBATE		$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			$ 16688.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	259.	$ 1974.	13.68	$ 26999.
B. DIST	$ .00	0.	$ 0.	14.64	$ 0.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 0.	15.38	$ 0.
N. TOTAL		259.	$ 1974.		$ 26999.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 0.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)	$ 0.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))	$ 1974.
5. SIMPLE PAYBACK PERIOD (1G/4)	8.46 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	$ 26999.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=	1.62

(IF < 1 PROJECT DOES NOT QUALIFY)

ENERGY PROJECT

PROGRAMMING DOCUMENTATION

Project Number and Title

FEMP2 - Emergency Generator Paralleling

Project Funding Category

Federal Energy Management Program (FEMP)

Contents

Attachment 1 - Description of Work

Attachment 2 - Life Cycle Cost Analysis Summary

Attachment 3 - Calculations, Cost Estimate and Back-up Data

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 1

DESCRIPTION OF WORK

FEMP 2 EMERGENCY GENERATOR PARALLELING

Description

The hospital currently uses two generators to reduce the electrical demand when requested by the local utility, Georgia Power and Light. One is 800 kW and the other is 2,100 kW. To meet the requirements of the Supplemental Energy (SE) rider, the hospital must reduce its demand below 2,960 kW during curtailment hours. The EAMC peak is about 4,200 kW. Even though the 2,100 kW generator cannot be fully loaded, the two generators easily meet the maximum reduction request. If the 2,100 kW generator was paralleled with utility grid, it could be fully utilized. Under the existing rate, the demand charge is only $0.80/kW for four months of the year and this would be of little benefit. However, the EAMC could apply for additional credits using the Interruptible Service (IS) rider.

Analysis

The IS rider credits the customer $45/kW annually for the contract amount. The EAMC would be required to reduce their demand by that amount. Using both generators (a total of 2,900 kW), the EAMC could reduce their demand 1,660 kW below their current billing demand. If the EAMC contracted for 1,500 kW, this would be worth $67,500 each year.

IS customers are called after SE and have only been called once in the eight plus years it has been offered. This occurred in 1995, required a total of 20 hours and overlapped SE calls except for one-half hour. Also, four hours of missed curtailments are allowed each year.

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 2

LIFE CYCLE COST ANALYSIS SUMMARY

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: F_2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: FEMP2 EMERGENCY GENERATOR PARALLELING
FISCAL YEAR 95 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 07-09-96 ECONOMIC LIFE 20 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$ 182400.	
B. SIOH	$ 10944.	
C. DESIGN COST	$ 10944.	
D. TOTAL COST (1A+1B+1C)	$ 204288.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$ 0.	
F. PUBLIC UTILITY COMPANY REBATE	$ 0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)		$ 204288.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	15.	$ 117.	13.68	$ 1605.
B. DIST	$ 5.41	-416.	$ -2251.	14.64	$ -32948.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 4800.	15.38	$ 73824.
N. TOTAL		-401.	$ 2667.		$ 42481.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 65200.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 841080.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)	$ 841080.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))	$ 67867.
5. SIMPLE PAYBACK PERIOD (1G/4)	3.01 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	$ 883561.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=	4.33

(IF < 1 PROJECT DOES NOT QUALIFY)
**** Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

PROGRAMMING DOCUMENTATION - FEMP

ATTACHMENT 3

CALCULATIONS, COST ESTIMATE AND BACK-UP DATA

RS&H

SUBJECT _____ AEP NO _____
SHEET _____ OF _____
DESIGNER Hutchins DATE 7/8/96
CHECKER _____ DATE _____

ECO EL4 Use Emergency Generator to Reduce Demand

The EAMC can add the Interuptible Service (IS) Rider and receive annual credit of #45/kW. The minimum is 200 kW and the maximum is 95% of their billing demand — this is 95% of 2960 kW = 2812 kW.

Calculate amount for IS Rider.

Current all time peak = 4200 kW
Billing demand (SE Rider) = 2960
Current needs = 1240 kW

Under the existing Supplemental Energy rider the EAMC needs at least 1240 kW to meet the contract requirement at peak load.

With full paralleling of 2100 kW the EAMC will have a generating capacity =
2100 + 800 = 2900 kW

Excess for IS = 2900 - 1240 = 1660 kW

Contracting for 90% of this yields

90% of 1660 kW ≈ 1500 kW

Savings = 1500 kW * #45/kW = #67,500/yr

RS&H

SUBJECT _____ AEP NO _____
SHEET _____ OF _____
DESIGNER _____ DATE _____
CHECKER _____ DATE _____

Calculate additional maintenance and fuel costs -

Fuel costs -

Performance is 15 kw / gal fuel oil

$$\frac{1500\ kw}{15\ kw/gal} = 100\ gal/hr$$

Assume it runs 30 hrs/yr.

$$\text{Fuel cost} = 100\ \frac{gal}{hr} * 30\ \frac{hr}{yr} * \$0.75\ \frac{}{gal} = \$2250/yr$$

Maintenance ≈ fuel costs ≈ $2300/yr

Electricity savings = 1500 kw * 30 hrs = 4500 kwh
= 15.4 MBtu

Demand savings = $0.80/kw * 1500 kw/mon * 4 mos/yr
= $4800

Fuel use = 100 * 30 = 3000 gal
= 416.1 MBtu (138,700 Btu/gal)

Convert fuel oil costs to MBtu

$$\$0.75\ \frac{}{gal} * gal\ \frac{}{138{,}700\ Btu} * 1E6\ \frac{Btu}{MBtu} = \$5.41/MBtu$$

CONSTRUCTION COST ESTIMATE

Project: ECO #EL4 Use Emergency Generator to Reduce Demand
Location: Fort Gordon, GA
Basis: Schematic Design
Building: Eisenhower Army Medical Center

RS&H No.: 694-1331-005
Date: 7/8/96
Estimator: P. HUTCHINS
Filename: EST_EL4.XLS

	QUANTITY		MATERIAL/EQUIP		LABOR		TOTAL	SOURCE	
ITEM DESCRIPTION	No.	Unit	$/Unit	Total	$/Unit	Total	COST	Material	Labor
Paralleling switchgear	1	ea	$85,000.00	$85,000	$48,500	$48,500	$133,500	(1)	(1)
2100 KW hardware & softw	1	ls	$5,000.00	$5,000	$2,900	$2,900	$7,900		
Protective relaying	1	ls	$5,500.00	$5,500	$3,100	$3,100	$8,600		
(1) Stewart & Stephenson, see backup information.									
This estimate includes overhead and profit									
Subtotal Bare Costs				$95,500		$54,500	$150,000		
Retrofit Cost Factors			0%	$0	0%	$0	$0		
				-		-	-		
Subtotal				$95,500		$54,500	$150,000		
City Cost Index (Aug. GA)			0%	$0	0%	$0	$0	MMp533	MMp533
				-		-	-		
Subtotal				$95,500		$54,500	$150,000		
OH & Profit Markups			10%	$9,550	0%	$0	$9,550	MMp7	MMp475
				-		-	-		
Subtotal				$105,050		$54,500	$159,550		
Sales Taxes			6.0%	$6,303		NA	$6,303	MMp476	
				-		-	-		
Subtotal				$111,353		$54,500	$165,853		
Contingency			10%	$11,135	10%	$5,450	$16,585	MEp6	MEp6
				-		-	-		
Subtotal construction Cost				$122,488		$59,950	$182,438		
Design Fee				NA	6.0%	$9,951	$9,951		
SIOH				NA	6.0%	$9,951	$9,951		
				-		-	-		
Total Project Cost				$122,488		$79,852	$202,340		

LEGEND:
MMp### 1996 Means Mechanical Cost Data, page ###.
MEp### 1996 Means Electrical Cost Data, page ###.
Gp### 1995 Grainger, page ###
Dp### 2/94 DGSC Energy Efficient Lighting, page ###

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: E_EL4
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID FY95 (92)
INSTALLATION & LOCATION: FORT GORDON REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: ECO EL4 USE EMERGENCY GENERATOR TO REDUCE DEMAND
FISCAL YEAR 95 DISCRETE PORTION NAME: N/A
ANALYSIS DATE: 07-08-96 ECONOMIC LIFE 20 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	182400.
B. SIOH	$	10944.
C. DESIGN COST	$	10944.
D. TOTAL COST (1A+1B+1C)	$	204288.
E. SALVAGE VALUE OF EXISTING EQUIPMENT	$	0.
F. PUBLIC UTILITY COMPANY REBATE	$	0.
G. TOTAL INVESTMENT (1D - 1E - 1F)	$	204288.

2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1991

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 7.62	15.	$ 117.	13.68	$ 1605.
B. DIST	$ 5.41	-416.	$ -2251.	14.64	$ -32948.
C. RESID	$ .00	0.	$ 0.	16.00	$ 0.
D. NAT G	$ 2.70	0.	$ 0.	17.25	$ 0.
E. COAL	$ .00	0.	$ 0.	15.38	$ 0.
M. DEMAND SAVINGS			$ 4800.	15.38	$ 73824.
N. TOTAL		-401.	$ 2667.		$ 42481.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		$ 65200.
(1) DISCOUNT FACTOR (TABLE A)	12.90	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		$ 841080.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
d. TOTAL	$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)	$	841080.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))	$	67867.
5. SIMPLE PAYBACK PERIOD (1G/4)		3.01 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	$	883561.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=		4.33

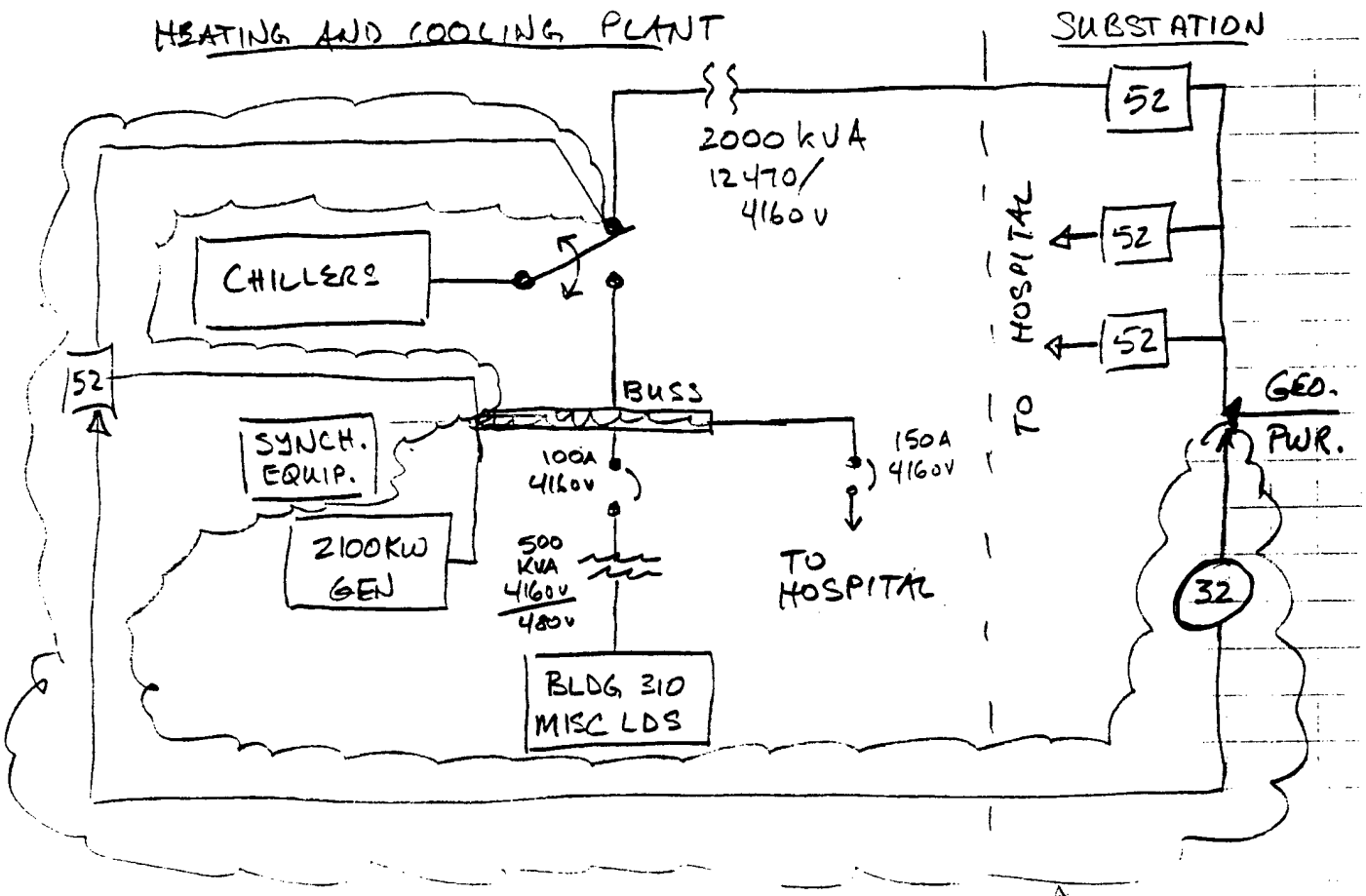
(IF < 1 PROJECT DOES NOT QUALIFY)
**** Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

RS&H

SUBJECT FT GORDON HOSPITAL
DESIGNER PAUL HUTCHINS
CHECKER

AEP NO
SHEET OF
DATE 6/26/96
DATE



GEN. 140 gal/hr at max ld.
(15 KW/gal fuel)

Maint. cost is about the same as fuel cost

DISTANCE BETWEEN SUBSTATION AND GENERATOR IS ~100 yds.

(52) Air Breaker
(32) Reverse current sensing relay

POWER SPECIALISTS

FAX COVER

Title : MR. **First Name : PAUL** **Last Name : HUTCHINS**

Company : REYNOLDS, SMITH AND HILLS, INC.

Subject : FT. GORDON

From : DAVID CURRY

Company : STEWART & STEVENSON, INC.

Fax Number : 713-671-6118 Voice : 713-671-6111

Pages : 1 Date : 7/3/96

Time : 12:16:40

NOTES:

PARALLELING SWITCHGEAR	$85,000.00
2100 KW HARDWARE & SOFTWARE	$5,000.00
PROTECTIVE RELAYING	$5,500.00
ELECTRICAL CONTRACTOR	$14,500.00
LABOR	$40,000.00

EL 4-6

RS&H®

Telephone Call Confirmation

Project Number _____

(713) 671-6111
-6118 (fax)

Local _____ L.D. ✓ Placed ✓ Rec'd _____ Date 6/26/96

Conversed with David Curry of Stewart & Stevenson Houston, TX

Regarding Synchronizing 2100 kw Gen. & Power Factor Correction

Other names - Richard Harris & Rodney Taylor
(713) 671-6100

DC said he could get budget estimates on both subjects in a short time.

Pit fixed schematic diagram of site drawn by Bob Calhoun

Distribution:

RS&H

Project Number _____

Telephone Call Confirmation

Local _____ L.D. ✓ Placed ✓ Rec'd _____ Date 6/17/96

Conversed with Michael Richardson of Georgia Power & Light

Regarding Interruptible Service Rider (IS)

The IS Rider calls for the user to reduce its demand by the contracted amount. Currently, the credit is $4.5/kW and is paid once a year. ~~On an annual~~

The minimum is 200kW. IS curtailments are called after SE.

Cannot use IS and Day Ahead RTP rates (This is the RTP rate the hospital would use since the other RTP rate, Hour Ahead, requires a minimum demand of 5000kW. Day Ahead requires 1000 kW minimum.

The IS requires a 3-year contract that "rolls over" each year. In other words you must stay on it for three years after notification to leave.

The hospital could contract up to 95% of their Billing Demand (2960KW) or 2812 kW

Distribution: